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ADDITIONAL POSITION PAPERS BASED ON INFORMATION GATHERED IN THE RECONNAISSANCE SURVEYS OF PLANNING AND PROGRAMING IN OCCUPATIONAL EDUCATION, REPORTED IN VOLUME ONE (VT 005 041), ARE PRESENTED. PART IV, CONCERNED WITH PROGRAM STRUCTURE AND BUDGETING AND THEIR RELATION TO THE PLANNING PROCESS, INCLUDES THE PAPERS--(1) "CURRENT POLICIES AND PRACTICES," BY ARNOLD KOTZ, (2) "THE PROGRAM BUDGET--ITS VALUE TO EDUCATION AT FEDERAL, STATE, AND LOCAL LEVELS," BY ROBERT N. GROSSE, (3) "BUDGETING FOR VOCATIONAL-TECHNICAL EDUCATION," BY THOMAS G. FOX, AND (4) "THE VOCATIONAL EDUCATION ACT OF 1963--INTERGOVERNMENTAL FISCAL RELATIONS," BY BRUCE F. DAVIE. PART V, AN ATTEMPT TO CLARIFY THE THEORETICAL AND METHODOLOGICAL ISSUES OF AN ECONOMIC ANALYSIS OF VOCATIONAL EDUCATION, INCLUDES (1) "BENEFIT COST ANALYSIS OF VOCATIONAL EDUCATION--A SURVEY," BY BRUCE DAVIE, (2) "ECONOMIC CONCEPTS AND CRITERIA FOR INVESTMENT IN VOCATIONAL EDUCATION," BY ERNST STROMSDORFER, (3) "A BENEFIT-COST FRAMEWORK FOR EDUCATION," BY ROBERT SPIEGELMAN, (4) "A SUMMARY GUIDE FOR BENEFIT COST ANALYSIS," BY EINAR HARDIN, (5) "MANPOWER DEMAND AND SUPPLY," BY ARNOLD KOTZ, (6) "EVALUATION OF SUPPLY-DEMAND PROJECTIONS, CONCEPTS, AND TECHNIQUES," BY THAYNE ROBSON, (7) "FORECASTING OCCUPATIONAL JOB REQUIREMENTS," BY NORMAN MEDVIN, (8) "MANPOWER REQUIREMENTS TO MEET NATIONAL GOALS IN RESEARCH AND DEVELOPMENT," BY LEONARD A. LECHT, AND (9) "EVALUATION" AND (10) "ORGANIZATION FOR PLANNING," BY ARNOLD KOTZ. A 15-PAGE "CHECKLIST FOR SCHOOL EVALUATION," A BIBLIOGRAPHY OF 111 REFERENCES, AND TRANSCRIPTS OF SEVERAL GROUP DISCUSSIONS ARE INCLUDED. THIS DOCUMENT IS AVAILABLE FOR $6.00 FROM STANFORD RESEARCH INSTITUTE, ROSSLYN PLAZA, 1611 NORTH KENT STREET, ARLINGTON, VIRGINIA 22209. (EM)

Research
Study

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VOLUME TWO

September 1967

Arnold Kotz, Editor

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STANFORD
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CONTENTS

VOLUME ONE

Transmittal Letter to Commissioner Harold Howe II. iii

Preface. vii

Acknowledgments. ix

Part I

INTRODUCTION AND MAJOR RECOMMENDATIONS AND CONCLUSIONS
By Arnold Kotz, Editor

Chapter 1 Introduction. 3

Chapter 2 Major Recommendations and Conclusions 7

Part II

OBJECTIVES AND GOALS

Chapter 3 Introduction. 33

Chapter 4 Objectives and Goals of Occupational Education By Grant Venn. 49

Chapter 5 Evaluating Vocational Education: Problems and Priorities, By Garth Mangum. 65

Chapter 6 Problems of Application of the PPB System to Education, By Charles J. Hitch 91

Part III

ALTERNATIVE PROGRAMS

Chapter 7 Introduction. 103

Chapter 8 An Educational System for the Seventies By David Bushness and Robert Morgan. 113

Chapter 9 An Industrial Approach to Occupational Training
By Wilbur Landis 123

Chapter 10 Improved Planning for Vocational and Technical Education: A State Director's Perspective
By Robert M. Worthington 155

APPENDIX A PARTICIPANTS IN THE AIRLIE HOURS CONFERENCE ON VOCATIONAL EDUCATION. 177

APPENDIX B STATE AND LOCAL OBJECTIVES AND GOALS FOR VOCATIONAL EDUCATION 183

REFERENCES 197

CONTENTS

VOLUME TWO

Part IV

PROGRAM STRUCTURE AND BUDGETING

Chapter 11 Current Policies and Practices 211

Chapter 12 The Program Budget: Its Value to Education at Federal, State, and Local Levels
By Robert Grosse 229

Chapter 13 Budgeting for Vocational-Technical Education
By Thomas Fox 261

Chapter 14 The Vocational Education Act of 1963: Intergovernmental Fiscal Relations
By Bruce Davie 281

Part V

CONDUCT OF SYSTEMS ANALYSIS

Chapter 15 Introduction 305

Chapter 16 Benefit/Cost Analysis of Vocational Education: A Survey
By Bruce Davie 309

Chapter 17 Economic Benefits and Criteria for Investment in Vocational and Technical Education
By Ernst Stromsdorfer 331

Chapter 18 Benefit/Cost Analysis of Education
By Robert Spiegelman 359

Chapter 19 Summary Guide for Effectiveness/Cost and Benefit/Cost Analyses of Vocational and Technical Education
By Einar Hardin 379

CONTENTS

Chapter 20 Current Concepts and Practices of Manpower Programming 387

Chapter 21 Evaluation of Supply-Demand Projections, Concepts, and Techniques
By Thayne Robson 397

Chapter 22 Forecasting Occupational Job Requirements
By Norman Medvin 409

Chapter 23 Manpower Requirements to Meet National Goals in Research and Development
By Leonard Lecht 425

Part VI

PROBLEMS OF EVALUATION AND ORGANIZATION

Chapter 24 Evaluation 437

Chapter 25 Organization for Planning 445

APPENDIX C CHECKLIST FOR SCHOOL AND PROGRAM EVALUATIONS . . 449

REFERENCES 467

ILLUSTRATIONS

III-1 Components of a High School Program to Achieve Entry to Posthigh School Activities. 117

-2 Model for a Single Course Instructional System 121

IV-1 A Taxonomy of the Program Structure: Objectives, Functions, and Recipients 231

-2 Detailed Decision Focus for the Program Structure . . . 233

-3 Program Category Code 240

-4 Measures of Program Elements Reported by Fiscal Year . 242

-5 Prospective Teacher Fellowships: Training of Personnel 243

-6 The Vocational Education Act of 1963 (Section 4): Intergovernmental Fiscal Relations, 1965 283

V-1 The Elements of Benefit/Cost Analysis 311

-2 Comparison of Three Evaluation Techniques 313

-3 Economic Benefit Profile of a Person as a Grade School Graduate Compared with His Economic Benefit Profile as a Vocational Graduate 335

-4 Time Income Stream of an Individual with Multiple Cost Outlays 348

-5 The Demand for and Supply of Personnel 393

TABLES

II-1 Illustrative Outline of the Objectives of Vocational-Technical Education. 39

IV-1 Possible Program Structure 213

-2 Tentative Major Program Structure 214

-3 Comparison of Marketplace Demand and Course Offerings . . 221

-4 Change in Course Emphasis from FY 1963 to FY 1966 221

-5 Major Program Categories 234

-6 Detail of Major Program Categories 235

-7 Educational Goals 237

-8 Program Objectives 237

-9 Program Character 238

-10 Educational Impact Level 238

-11 Development of Vocational and Occupational Skills 239

-12 Results of Selected HEW Campaigns 247

-13 Illustrative Expenditure Budget for an Area Vocational-Technical School Using Functional and Line Item Classification 263

-14 School System Enrollment as a Percentage of States' K-12 Enrollment and Vocational, Trade, and Technical Enrollment 267

-15 Comparative Personnel, Materials, and Supply Costs by Activity and Organizational Unit for Chicago Public High Schools 268

-16 Illustrative Program Budget Format for an Area Vocational-Technical School 273

-17 Basic Allotments, Reallotments, Transfers, and Expenditures of Section 4 Funds of the Vocational Education Act of 1963, by State 294

-18 Distribution of Expenditures under the Vocational Education Act of 1963, by Purpose 296

-19 Ratio of Reported State-Local Expenditures to Federal Expenditures for 1963 Act Purposes and Adjustments for Reductions in Reported State-Local Smith-Hughes and George-Barden Act Expenditures and for Office Occupation Expenditures, by State 299

TABLES

V-1 Months Required to Find Initial Job: Comparison of Vocational and Academic Graduates (Based on Cases That Went Directly to Work) . . . 317

-2 Methods Used to Get First Full-Time Job, by Type of Graduate . . . 317

-3 Employment Security: Comparison of Vocational Academic Graduates (Based on Graduates with No College Education Who Have Approximately Six Months' Employable Time) . . . 318

-4 Wage Rates: Comparison of Vocational and Academic Graduates with No College Education . . . 318

-5 Trend in Number and Percentage of Vocational Graduates Placed in Four Categories of Relationship Between Trade Studied and First Full-Time Job . . . 320

-6 Tools and Equipment: Comparability Analysis and Time Required to Learn to Use Very Much Different Tools and Equipment, by Year of Graduation . . . 321

-7 Average Monthly Incomes of Gaston Tech and High School Graduates for Specified Months After Gaston Tech Graduates Completed Technical Schooling . . . 322

-8 Regression Coefficients and Standard Errors . . . 322

-9 Average Private and Public Costs per Gaston Tech Graduate for Two Years of Technical Schooling . . . 324

-10 Rates of Return and Benefit/Cost Ratios on Investment in the Technical Education of Gaston Tech Graduates, by Projection . . . 324

-11 Total Public per Pupil Costs . . . 327

-12 Number of Years Wage Differentials Would Have to Remain for the Present Value of Extra Costs to Equal the Present Value of Extra Returns . . . 327

-13 Constraints on Decision Rules . . . 347

-14 Symbols Used in Benefit/Cost Model . . . 366

-15 Job Vacancies and Unfilled Job Openings: Selected Three-Digit Occupations as a Percentage of Each Major Occupational Group . . . 432

-16 Expenditures for Individual Goals . . . 433

TABLES

V-17 Employment by Occupational Group for the R&D Goal . . . 433

-18 Employment by Detailed Occupation for the R&D Goal, Selected Occupations 434

PART IV

PROGRAM STRUCTURE AND BUDGETING

Chapter 11

INTRODUCTION

The chapters in Part IV are concerned with program structure and budgeting and their relation to the planning and programming process. The reconnaissance surveys found a marked lack of integration between the substantive programming of vocational education courses and the fiscal planning at the state and local level. Fiscal planning was and is performed in terms of budget categories, such as teacher personnel, school construction, and operations and maintenance, including line items for light and heating, and transportation. The substantive planning is done by personnel other than those responsible for the detailed budget preparation and is concerned with issues such as the determination of what courses to offer, where to offer them, and the development of curriculum for each course.

The substantive planning is concerned with the overall objectives of the vocational process that is undertaken to graduate students and place them in jobs, enhance their earning stream, reduce unemployment and social tensions, and fulfill other objectives and goals previously discussed. The substantive planning will also be concerned with derivative objectives such as the behavioral outcomes expected of the students completing a specific course as indicated by tests and other measurements, recruiting professional staff, and ensuring that sufficient facilities and classrooms are available to conduct the operating programs. No adequate devices, programs, procedures, or information systems were found to be in existence to relate, in a realistic manner, programs, total budget estimates, or total expenditures to the objectives or goals sought. The divorce of the substantive planning from the fiscal planning raises serious obstacles to rational decision-making and exercise of the hard choices that are the responsibility of managers of the educational institutions.

The survey found that facilities planning is projected for five years or more. However, the programming and budgeting for operation of the educational programs are performed on an annual or two-year basis. The operating and maintenance planning and the budget preparation are performed primarily on an incremental basis, with justifications of changes for the ensuing year over the prior year representing the only explanations required. In short, the existing system does not require educational planners to face up to the hard choices that are part of a manager's responsibility. It should be emphasized that this is not the personal fault of the educational manager, but a description of the deficiencies of the educational system as it has developed over many decades. As pointed out in the chapter by Charles J. Hitch, similar deficiencies were found in the military establishment. He stated that: "in organizations with similar systems, academic planners and business planners act just like the military planners."

Program Structure

Whereas planning as part of a decision-making system is concerned with the creative design and systematic consideration of alternative means to achieve objectives and goals, programming focuses on the determination of the materiel, facilities, manpower, funds, and the time-phased actions necessary to achieve the program objectives. An output-oriented program structure is designed to categorize the major governmental programs to achieve the objectives, grouping all like activities by major program and subprogram categories. Program elements are established within the major programs as the units for programming dollar costs, manpower, and materiel and represent integrated activities by means of which the goals are accomplished. The important criteria to be met in their design include that they represent major purposes, are either final or intermediate output oriented, and facilitate comparisons of alternatives, the collection of essential data, and the development of the budget. The source of reporting would be the specific school.

Table IV-1 illustrates a possible program structure. The subprogram category structure suggested follows the primary occupational category structure now in general use in vocational and technical education. Both it and the program element structure are output-oriented and permit collection of costs and benefits in a form that can be used for comparing alternative programs; planning and programming of course sequences and manpower, equipment, classrooms, and dollar costs related to the program elements; measuring outputs (graduates placed in jobs); and collecting and displaying costs for budget or accounting purposes.

In terms of the economic efficiency objectives listed on Table II-1, outputs can be measured through benefit/cost ratios, with the benefits reflecting the earning streams of graduates placed in jobs. In terms of the educational objectives listed, performance on achievement tests for reading comprehension, computational and reasoning abilities, language, etc., can be compared among schools, cities or states for quality and quantitative behavioral outcomes or against costs for both behavioral outcomes and economic efficiency.

One city is in the early stages of establishing a PPB system for kindergarten through the 12th grade. Its tentative program structure is set forth in Table IV-2. The program element is the school. The program elements are not yet output-oriented, but the size and complexity of the school system creates formidable data collection problems. Currently, all data are collected by specific school source. The reporting design will provide for yielding output-type data for purposes of analysis, similar to the more advanced design suggested above. This will facilitate conversion in a follow-on stage directly to output-directed program structure and program elements.

Table IV-1

POSSIBLE PROGRAM STRUCTURE

Major program category: Vocational and Technical Education

Subprogram:	Office Education	Technical Education
Reporting by:	(school x)	(school xx)
Elements:	Bookkeeping Typewriting Stenography Clerk, file Data processing, clerical Other	Chemical engineering technology Civil engineering technology Electrical engineering technology Mechanical engineering technology Data processing, technical Other

Related data including costs:

- Instructional personnel
  - Regular teachers
  - Substitute teachers
  - Supervision
  - Other
- Noninstructional personnel service
  - Secretaries
  - School aides
  - Guidance counselors
  - Librarians
  - Lab assistants/School laboratory technicians
  - Other
- Other than personnel services--instructional
  - Supplies
  - Equipment
  - Equipment repair and maintenance
  - Other
- Support services
  - Transportation
  - School lunches
  - Research and development (directly relatable)
  - Other
- Administrative services chargeable
  - Principal
  - Administrative assistants
  - Others
- Operation and maintenance
  - Custodial services
  - Building repair and maintenance
  - Building improvements
  - Equipment repair and maintenance
  - Utilities
  - Custodial supplies
  - Other
- Other

Table IV-2

TENTATIVE MAJOR PROGRAM STRUCTURE

I Primary Education

II Intermediate Education

III Career Preparatory Education

IV Special Education

V Research and Development

VI Community Activities

VII General Support

VIII Headquarters Administration

Major Programs: Career Preparatory Education

Subprogram A: Academic Day High Schools
B: Day Vocational High Schools

Objective: To provide a broad gereral high school education and opportunity to prepare for an entry job in a specific trade or cluster of related trades, or admission to an institution of higher learning. Facilities are also provided for individuals who are graduates of academic high schools and are seeking to develop some salable trade skill.

Program Element 1: Vocational High School

(Data below will be displayed separately for each school in this major aggregation)

Instructional personnel service

- Regular teachers
- Substitute teachers
- Supervision
- Other

Noninstructional personnel service

- Secretaries
- School aides
- Guidance counselors
- Librarians
- Lab assistants/school laboratory technicians
- Other

Table IV-2 (concluded)

- Other than personnel services--instructional
  - Supplies
  - Equipment
  - Equipment repair and maintenance
  - Other
- Support services
  - Transportation
  - School lunches
  - Research and development (directly relatable)
  - Other
- Administrative services chargeable
  - Principal
  - Administrative assistants
  - Others
- Operation and maintenance
  - Custodial services
  - Building repair and maintenance
  - Building improvements
  - Equipment repair and maintenance
  - Utilities
  - Custodial supplies
  - Other
- Other

The program structures could differ significantly among national, state and local levels, as can be observed from the suggested structures set forth above and in the papers by Robert Grosse and Thomas Fox. The program structure should be refined and sharpened with use and experience gained in the planning and decision-making system. As program emphasis changes or new programs are introduced, they will suggest changes in the program structure to improve its contribution to the management of educational resources.

Multiyear Program and Financial Plan

The budget sets forth the financial costs of the manpower, materiel, facilities, and equipment by program category and by year. A PPB system is set up to encompass most of the long lead time actions to ensure that costs in the coming year, as well as follow-on year costs, are visible and not obscured. The decision, for example, to conduct a two- or four-year training program for technicians requires obtaining classrooms and purchasing equipment, hiring teachers, programming enrollments, and other actions that will incur costs for more than one or two years. Usually, this will require setting forth data for the prior year, the current year, and a five-year budget including the next year and four years thereafter. The first year, once approved, becomes the operating budget, and a subsequent year is added in a continuous cycle of updating. It is usually useful to refashion budgets so that they relate directly to the program category structure. However, this is not essential, since statistical and cost-center data can be collected and converted to the conventional manner of presenting data to legislative bodies. At any time, an approved program will indicate the scope, magnitude, and time-phasing of the plan to achieve the objectives and goals, and the financial plan will display the relevant dollar costs, both capital and noncapital. The major expected sources of external revenue should be identified, and net costs to the state or community should be indicated.

The contents of this chapter that follow describe the findings with respect to existing policies and practices in the several states and communities in which the surveys took place. The discussion of the need for developing a program structure and related multiple-year budget programs is particularly relevant to the issues discussed in this volume. However, the development of a program structure that will facilitate the consideration of alternative courses of action and assist management in making the hard choices will not be an easy task. Vocational education shares mutual interests with other programs, such as manpower development and training, programs to reduce social tensions and unemployment, programs to provide for equity, and many other active programs in the pursuit of common objectives and goals. Vocational does have some trade-off with academic and general track courses in secondary education, and the interdependencies must be evaluated. The development of the program structure for vocational education must be aware of the related and competing programs in the design stages to facilitate the application of analytical techniques.

Chapter 12 by Dr. Robert Grosse considers "The Program Budget: Its Value to Education at Federal, State and Local Levels," from the perspective and interest of the U.S. Department of Health, Education, and Welfare. He describes the action in process to establish a PPB system in HEW and apply it in the educational sector. The program structure he sets forth is particularly relevant to the federal level, and may not be as meaningful to state and local jurisdictions. His discussion of the use of benefit/cost studies in decision-making opened up a lively discussion among the experts.

Dr. Thomas Fox's "Budgeting for Vocational-Technical Education," Chapter 13, contains findings that are consistent with and reinforce those of the SRI surveys. The discussion that follows considers the relations between the federal, state, and local jurisdictions in planning and programming, with a general consensus that the primary responsibility lies primarily with the local community.

Chapter 14, by Dr. Bruce F. Davie, considers intergovernmental fiscal relations and the Vocational Education Act of 1963. It explains the background and major provisions of the Act and describes the major thrust of that legislation and its impact on intergovernmental fiscal relations as it affects vocational education.

Current Policies and Practices

Program Structure

The surveys found that the states plan and program for vocational education using the seven major occupational categories: agriculture, distribution, health occupations, home economics, office education, technical education, and trades and industry. One state did not include health as a separate category. Additional primary programs include staffing (teacher recruitment and training), facilities construction and improvement, curriculum development, research, and counseling. One of the states, with strong centralized direction, plans courses and course sequences by occupational categories within the technical institutes and the area vocational-technical schools that are under its direct jurisdiction. The same state also plans and programs within occupational categories for vocational education programs conducted by secondary schools in the school districts, in cooperation with the localities.

The practices among the local jurisdictions vary. Where the board of education in a community rather than a state has full responsibility for vocational education, it uses a similar occupational category structure for programming as that described for the states. However, in one state where there is very strong centralized control, the local jurisdictions provide only such courses as home economics, agriculture, and office and distribution education occupational categories as part of the secondary school program. In the latter instance, separate area vocational schools provide programs at the secondary and postsecondary levels in the balance of the occupational categories, with some minor exceptions.

The program categories represent groupings of a sequence of related course offerings that, when successfully completed, equip the student with the skills necessary for performance in a job or cluster of related jobs. The broad occupational groupings generally describe the broadly related job families in which the students are being trained with the objective of filling positions after graduation or meeting other objectives of education. The training is conducted at the secondary or postsecondary level for full-time regular day students or for adults who have left school or for those with special needs.

The broad occupational categories represent a level of aggregation that is now used mainly to manage the sequence of course offerings falling within the specified categories. The categories are not mutually exclusive, since an entry level course in data processing may be offered under technical training at a technical institute or as a course in office education at a high school. The course in office education at the high school may not go beyond key punching, but the technical institute may have a series of advanced courses on programming and concepts of data processing. Similarly, courses may be offered on consumer economics in both office education and in home economics. Generally, however, the course offerings are fairly well differentiated among the occupational categories.

The primary occupational categories are used to facilitate management and program development for a collection of related job families. For example, one person's responsibilities at a state level is to expand the number of course offerings in office education in the school district for the purpose of helping in curriculum development and encouraging enrollment. Another person has a similar assignment for home economics. Both aid localities in setting up courses and view their role as largely promotional.

The program category structure is not directly relevant in requesting funds from the state, since the budget structure and processes are not directly related to or dependent on it. The existence of the occupational categories makes it easier to describe in aggregate terms the various activities being conducted. Descriptive reports are provided in USOE in terms of the broad categories by enrollment and number of course offerings. However, programming and budgeting at the state or local level requires more detail. Actual programming is based on specific classes and the offering of course sequences that equip the student with skills necessary to operate as a bookkeeper, typist, electronic technician, or other.

The programming takes place in relation to such class and course offerings. Student enrollment permits derivation of staffing patterns through established faculty-student ratios. Staffing costs represent more than 70 percent of the school operating budget. Programming proceeds on an incremental basis from data for the prior year, with attention given only to significant changes from the base. Increased enrollment, more teachers, salary increases, and new equipment or course offerings require justification to the board of education and to the legislature. Facilities programming is usually related to the occupational categories when a new technical institute or area vocational-technical school is planned. Enrollment is shown by anticipated course or program offerings. Overhead costs are not divided by course or occupational category, although most jurisdictions claimed this could be done if required.

When an entirely separate facility is used for vocational education, the operating and maintenance costs such as fuel and heat, transportation, food, and health and nursing service are programmed by the vocational educators. In comprehensive high schools, however, such activities and their costs will be programmed or costed as separate line items so that the full costs of vocational training are obscured.

The current use of the occupational category structure is rather limited. The categories are not used to facilitate the development of alternative courses of action or to help determine choice among them. They are also not used to determine and compare the benefits and costs of training individuals in different occupational categories or jobs. Comparative studies are not conducted of the relative merits of different program offerings or course sequences within a single occupational category in terms of economic efficiency. No attempt is made to establish priorities among the several primary occupational categories or among the specific courses offered in each of them. Benefit/cost analysis techniques or related economic efficiency criteria are not being used or applied to assist planning and programming. This applies to both state and local levels. One community had just started a benefit/cost analysis project, but this was in a very early stage of development.

Federal requirements have resulted in an additional set of planning categories. Enrollments in the number of courses to be offered for secondary and postsecondary education, adult education, and education of persons with special needs are projected and reported to the U.S. Office of Education annually. It is intended that use of such planning factors should assist the states and local jurisdictions in providing the program emphasis that would relate the supply of persons trained in occupational fields to the demands of the marketplace and to serve the equity objectives of equal opportunity.

One state analyzed projected course offerings as an indirect way of relating enrollments to demand by broad occupational categories. The course offerings and enrollments represent resource inputs, not the final products of the objective of economic efficiency--the graduates who are available for immediate placement. There can be only limited value of course offerings as indicators, since one must assume some functional relationship between course offerings, enrollments, and graduates. A brief comparison was made of current course offerings and marketplace demands in two jurisdictions. Table IV-3 shows that only 2.6 percent of the course offerings in the state for FY 1966-67 were projected for occupations that the state considered to be most urgently needed--the professional and managerial categories including subprofessionals and technicians. The largest number of courses offered were for home economics education (22.8 percent of total courses) and office and distributive education (48 percent), the need for which had been indicated by the state as "not critical." The analysis showed a "severe" need for the service occupations, such as licensed practical nursing, but only 1 percent of the total courses were in this area. Either the state's determination of marketplace demand was wrong or there is a substantial lack of responsiveness to the demand as reflected in the course offerings throughout the state. However, these comparisons are not accurate since there is no knowledge of average class size and no knowledge of the absolute number of graduates from each skill needed in the labor market.

Course offerings are unreliable measures of enrollment since, as requested by the U.S. Office of Education, it is reported by occupational category by locality. The number of enrollments can be small in one town and large in another. Distortions thus introduced are likely to be highly significant. In addition, further distortions can be introduced as similar courses are offered in area vocational-technical schools or other public institutions serving several localities. A direct estimate of enrollments would be more meaningful for planning and programming purposes. One state, as indicated in Table IV-4, provided such enrollments in its Projected Activities Report. It is apparent from the data that home economics enrollments as projected would increase in absolute and percentage terms from FY 1963 to FY 1966. The Projected Activities Reports indicated that the most urgent requirements are in the skilled services and technical occupational fields. The survey established that there were shortages in the health occupations, but these occupations represented only 1 percent of enrollments in 1966, while the home economics enrollment almost doubled in 1966 over 1963, and increased to 23 percent when office education enrollment is excluded from the 1966 data. The significant conclusion here is that the enrollment data do not appear to reflect positive programming in response to the priority of need for occupational requirements as identified by the state. The data cannot be considered accurate, since inspection of source documents for the jurisdiction surveyed indicated that they include summation of dissimilar reporting units; i.e., full-time and part-time enrollments in preparatory courses and enrollees with part-time attendance in extension programs.

Facilities Planning

Most of the states surveyed have extensive experience in planning and programming new facilities or improving existing ones. The states' construction programs usually cover a six- to ten-year planning period. Programs and budgets are usually submitted to the legislature for a six-year period, with construction programs and their costs set forth for either annual or biennial periods. For illustrative purposes, the following plan for a school currently under construction is provided. Total capacity for this area vocational-technical school is planned at 370 students. It is

Table IV-3

COMPARISON OF MARKETPLACE DEMAND AND COURSE OFFERINGS
(FY 1966-67)

Occupational Categories	Marketplace Demand*	Projected Course Offerings in State† Number	Percent of Total
Agriculture	Serious but not critical	387	17.4%
Distribution	Not critical	294	13.2
Health occupations	Severe	26	1.2
Home economics	No estimate	508	22.8
Office education	Not critical	765	34.3
Technical education	Urgent need	58	2.6
Trades and industry	Serious but not critical	189	8.5
Total		2,227	100.0%

---

* Judgments made by Vocational Education Bureau on basis of best available information.

† Compiled from detailed county listing of program offerings provided by the Vocational Education Bureau for FY 1966-67.

Table IV-4

CHANGE IN COURSE EMPHASIS FROM FY 1963 TO FY 1966

Occupational Categories*	Percent of Total Enrollments* FY 1963	FY 1966
Agriculture	3.0%	2.4%
Distribution	1.1	3.5
Health	2.1	1.5
Home economics	19.2	22.6
Technical†	17.6	37.4
Trade and industry†	57.0	32.6
Total	100.0%	100.0%

---

* Office education excluded since it was not reported for 1963.

† Possible change in reporting definitions could have been responsible for change in trade and industry.

Source: Vocational and Technical Education, USOE FY 1963; FY 1966, USOE preliminary data by states.

being built in a region of the state where no student is now more than 25 miles distant from an area vocational school. It would offer instruction in the skilled occupations at the secondary level in the following occupations: an enrollment of 30 in the tool and diemaking curriculum, 60 in carpentry, 60 in electrical, 60 in automobile repair, 30 in beauty culture, and 30 in industrial electronics. In conjunction with the vocational work, a balanced general and related education program on the secondary level is offered in English, science (industrial physics and chemistry), mathematics (algebra, geometry, and trigonometry), social studies, social legislation and problems of democracy, and physical and health education.

Facilities planning includes development of space and floor plan requirements and layout in consideration of day and evening enrollment in programs. Other factors include selection of school site, preparation of a financial requirements report, equipment layout, and studies of school accessibility of the school to potential students. The population and geographic area to be served are also considered. Along with other demand survey results, job vacancy data are used to the extent that they are available. The usual steps of approval of preliminary plans, preparation of final working drawings, and erection of buildings proceed after financing and authorization is given.

In a major metropolitan area of one state, it has long been assumed that before new facilities are built to expand a vocational school, maximum utilization will be made of existing space. Guidelines also require that the facilities must not be overutilized to the point that educational quality is adversely affected.

To provide an objective means of evaluating the adequacy of the existing physical plant, two measures are applied to long range forecasts of student enrollment:

1. The State Coordinating Committee for Higher Education recommended that classrooms be scheduled for 30 periods per week and that laboratories be scheduled for 24 periods per week.

2. The desirable level of space per full-time student is 185 square feet. (This space includes classrooms, shops, laboratories, corridors, offices, recreation space, and washroom and locker facilities, as well as storage areas.)

In another community, a situation was identified in which one-third of the capacity of a vocational school was not being used. A policy was proposed to attract 9th grade students to this school, which now admits pupils from the 10th through the 12th grades. (Since the survey was conducted, this policy has been approved.) This particular community's overall objective is to increase enrollments in the secondary vocational schools. In another community, the objective is to encourage as many graduates from the academic or general track courses as possible and to defer occupational choice to postsecondary time frames. Obviously, these two approaches are in conflict.

Population growth and new course offerings could conceivably attract additional students in the future to ensure better balance between capacity and student enrollment. There is obviously substantial merit to the facilities planning process. However, gaps in the information system raise questions on whether optimum decisions are being made and maximum benefits returned in relation to costs and goals. Could some of the courses be offered in regular high schools, thereby avoiding premature commitment to a narrow occupational specialty? Have alternative strategies been considered, including on-the-job training or cooperative work study programs with attendance at academic high schools? Have priorities been established among the course offerings? If so, on what basis? What is the relationship of capacity to enrollment; of enrollment to course completion; of course completions to placement in jobs for which trained and to duration of jobs since placement? These questions are not now answered by the planning and programming process, the Projected Activities Report, or the annual statistical or descriptive report.

Public Law 88-210 imposes a financial constraint that substantially affects planning. In Section 4(b) of the Act, it states that one-third of each state's allotment (25 percent in FY 1969 and thereafter) will be used (1) for vocational education for persons who have completed or left high school and who are available for full-time study in preparation for the labor market or (2) for construction of area vocational education school facilities. An appeal may be made to the Commissioner of Education to use a smaller percentage.

The legal requirement perhaps could contribute to unrealistic expansion of facilities. If the capacity of facilities to accommodate adults and dropouts for a particular planning year is adequate, a state could decide not to spend funds on facilities and thus lose federal money. Some states--to achieve the objective of having vocational facilities within easy access of all students in the states and to ensure full use of funds made available--could blanket the state with area vocational-technical schools. One state appeared to have construction of facilities as its major objective. If the construction and distribution of such schools is decided on a first come, first served basis, it would not be a rational allocation of resources with respect to regional occupational demand.

In a previous section of this report, alternative courses of action to achieve vocational education objectives were identified. It was made clear in the surveys that facilities are being constructed without adequate regard for the implications of alternative courses of action. Since land purchase and facility construction expenditures are usually costly, the need for careful planning to facilitate decisions is obvious. Choice of one course of action, or of combinations of them, would have a direct and significant effect on the construction of new facilities and the improvement of existing ones. The FY 1966 hearings on the Act indicated that some of the area vocational schools may cost as much as $5 to $15 million each. The testimony indicated that there are a total of 651 area vocational schools in 50 states and territories. The presentation stated that,

> At the present rate of construction, by 1970 there would be provided a nation-wide system of 1,333 area vocational education schools which would lead substantially to vocational education opportunities readily accessible to persons of all ages in all communities in the states.[3]

The uncertainties in the current planning processes, the large scale resources being consumed, and the importance of decisions to affected students suggest the need to improve the entire planning processes, including the relation of decisions to construct facilities more directly to specified objectives and goals and the programs designed to achieve them.

Budgeting

The budgeting practices and procedures of the states and communities reviewed vary widely. In general, an incremental budget is used, setting forth the actual dollar expenditures of the prior year or years and the request for the next biennium. Increases in enrollments, faculty staffing, contractual services, materials and supplies, facilities and other properties are shown from this base, and explanations for the reasons for increases or decreases are offered. The dollar costs of programs tend to be aggregated in terms of personnel services and the other line items of resource inputs such as materials and supply, contractual services, and permanent property.

Aid to localities by the state is also shown, divided to distinguish between personal services and the other line items such as construction reflecting resource inputs. A state with a separate board of vocational education presented much greater detail and justification of its programs, but all the states used the incremental approach in their budgeting as well as in their programming.

The state with a separate board of vocational education showed the prior actual budget; the estimated budget for the current year; and the request for the biennium showing the dollar estimates for secondary schools, youth and vocational schools, youth and secondary schools pursuing vocational programs, adult and full-time posthigh school programs, unemployed youths and adults full time, adults part time to upgrade skills, adults with special needs, and construction of vocational school facilities. These estimates represent the bulk of the vocational education budget. Costs for research and development to study and improve vocational education and for administrative overhead are added. The increase in both dollar values and work load for the budget years is then compared with actual expenditures in prior years.

Actual and projected enrollments are provided in the state budgets and are the basis for determining school staffing requirements. Faculty-student ratios are used to determine staffing requirements, and changes are justified where additions are shown because of increased enrollments or changes in staffing ratios. Since personnel services reflect 70 to 80 percent of the operating budgets, changes in teachers' salaries due to merit increases or overall increases must be justified.

The state with the separate board of vocational education submits a separate vocational-technical budget of more than 50 pages. Another state's vocational education operating budget consisted of one page in the state board of education's comprehensive budget.

Facilities construction expenditures budgets usually require a longer lead time than annual operating and maintenance expenditures. The facilities program is outlined for six years with estimates for each of three biennium periods. The building program is usually shown as part of the capital budget, separate from the operating and maintenance budget. Line items are shown for each technical institute or area vocational school with amounts identified for the public school. Six years are used because it is felt that the legislature should have displayed before it the full costs of facilities, not just those for a two-year beginning program. Once the facilities are constructed, the costs of operating them will appear in the operating budget.

In the budget presentation to the board of education and in reviews at higher levels, there is usually no attempt to break out the vocational education budget request in detail by occupational categories or by specific course offerings. There is no attempt to spread the costs of operation and maintenance of facilities over occupational categories or specific course offerings. However, data are supplied at some state levels showing enrollment by dollar costs for categories such as education of secondary, postsecondary, adult, and students with special needs.

The U.S. Office of Education requires a report with a breakout of all federal funds received for vocational education by the state during the year. The report shows the different legislative acts from which the funds were derived. The report shows the total amount and separately the federal, state, and local amounts that were spent on secondary and postsecondary education, adult education, education of persons with special needs, and ancillary services. It shows the federal, state, and local amounts being spent on homemaking, health, and technical training under the George-Barden Act. Separate pages are prepared with a breakdown of expenditures by primary occupational categories, but these do not show enrollment. In home economics, for example, one state spent $495,000, of which approximately $93,000 represented federal funds. This contrasts with state and local expenditures of $86,571, and federal expenditures of $27,280 for health occupations.

Although the cost data are not now collected by primary occupational category or by specific course offerings, some jurisdictions claim they can derive these data from their records. This task would probably prove quite difficult. The basic information is readily available for the largest expense item, i.e., teaching services. Analysis would be required to develop a reasonable method for collection of other expense items and costs so that expenditures could be identified by end purposes. The use of such information for benefit/cost analyses, effectiveness/cost analyses, and other management purposes would require some restructuring of basic source documents if not of the budget for operation and maintenance.

Some of the vocational educators stated that federal funding constraints did not particularly inhibit their planning or programming of vocational education. Funds from all sources were assumed to be thrown into a general fund. Programming and budgeting, as well as reports to satisfy the constraints imposed by federal requirements could then be considered _ex post facto_ rather than as the consequence of prior planning. This could mean that some adjustments would be necessary to fit enrollments and programs into the necessary constraints of fund allocation. Other than fund availability, other constraints that affect the planning and programming process are teacher shortages for some occupational categories, shortages of facilities, lack of identification of job demand, and lack of student interest.

The major categories used in budgeting are personnel services; contractual services such as advertising, printing, insurance, utilities, and fuel; and purchases in the community. In a strongly centralized state, there was a separate presentation of personnel services for technical institutes and area vocational-technical schools with the "other expenses" all combined. The operating budget is usually appropriated for two years, although it is actually divided into annual amounts. Public hearings for the budget for FY 1968 and FY 1969 will take place between January and June of 1967. As for the capital budget, one division of vocational education makes a ten-year plan for all state facilities and submits its estimates for a six-year period to the legislature.

Comparisons Among Communities. There is substantial variation in budgetary practices and methodology among the communities. None of the 11 communities, however, was able to supply the kind of budgetary data required for program budgeting. With special effort, it would be possible for four or five of the communities to derive reasonably accurate data on expenditures and receipts for vocational education and a breakdown consistent with the primary occupational categories. It would be difficult to obtain accurate data on a detailed basis (for example, for specific course offerings) without extensive overhaul of the budgeting and costing system.

Review Levels. Before a project can be funded, it must be evaluated and found to meet the provisions of PL 88-210. The results of such evaluations will be used as a basis for determining an equitable allocation of the available funds.

The major steps in budget review and approval where state or federal cost sharing is included are:

1. The localities submit their requests for funds.
2. The budget is developed at the state level after review and summation of local needs.
3. Approval with or without changes is given by the state board for vocational, technical, and adult education.
4. Depending on the state, portions of the budget are approved by the coordinating board for higher education or by the state board of education.
5. The state department of administration approves the adjusted budget.
6. The governor approves the budget.
7. The legislature approves the budget.

Budgets are organized differently among localities. Definitions of categories differ and different levels of aggregation and disaggregation occur among localities so that intercity comparisons of budgets would be difficult to make. In short, as the community budgets now stand, they would be difficult to use for cost/benefit analysis and their utility for other PPBS purposes is limited.

It is not clear how much special effort would be required to break out the data necessary for valid benefit/cost analyses. Several schools reported that they had or were installing computerized accounting systems, although these are of no value if the data are reported in the wrong format. In several schools, it was indicated that the desired degree of detail was available but in unpublished form. Some jurisdictions were reluctant to supply any budget material even though it probably was already compiled.

The vocational and technical budgetary items will generally be aggregated with total secondary education. Exceptions are cities in states where the vocational program is independent of other types of secondary education and where extensive reliance is placed on state-directed secondary vocational-technical schools.

Most communities projected the operating budget ahead for two years. One community could not provide projected total data for vocational education. With respect to the capital budget, six communities could not supply adequate data on the projected capital budget. Apparently, this is because the funds are controlled by the state vocational education authorities or because capital funds are obtained on an *ad hoc* basis through the local boards of education. In at least one community, sizable capital funds were obtained through a special local property tax levy recommended by the local school board. Three communities reported capital budget planning for five or six years ahead.

All of the 11 communities were using incremental type budgeting, with budget year requests based on prior year actual expenditures.

Summary. As in the programming processes, the budget is developed from the base of the prior year, with only significant changes shown and justified. One jurisdiction's procedure called for showing "no change from prior years" on its forms. This response implied the same size of dollar request as for prior years and usually would be honored.

Current budgeting procedures do not permit relating program requests and expenditures to the primary program categories or specific course offerings. Budget practices make impossible the collection of costs for display and comparison with benefits for alternative offerings either aggregated into occupational categories or disaggregated at the specific course level. Most persons interviewed stated that the jurisdictions could break down the estimates or expenditures from source documents to meet such requirements for data. However, it is felt that this view is overly optimistic. Refashioning of the budgetary system would be required to serve the purposes of a sound planning and programming system.

Chapter 12

THE PROGRAM BUDGET: ITS VALUE TO EDUCATION AT FEDERAL, STATE, AND LOCAL LEVELS

by

Robert N. Grosse

Background

There has been a lot written, said, and done in the name of planning, programming, and budgeting, yet it is difficult to say exactly what programming, planning, and budgeting are. I thought it might be helpful to tell you something about what we are trying to do in the Department of Health, Education, and Welfare with respect to planning, programming, and budgeting and to show something of the relationship of our general activities to the analysis of vocational education.

Also, at HEW, we have had no systematic planning processes. Our budgets have usually started with statements of needs at very low echelons for the budget year, which have then been reviewed and consolidated. Need calculations started with the existing base, to which were added "built-in" increments and commitments of the Administration. Above this level (up to existing authorization levels), programs were expanded reflecting historic rates of increase, records of ability to spend funds, and anticipated work loads (frequently applications for grants). When Bureau of the Budget ceilings became known, budgets were readjusted with more stringent application of the same criteria.

The legislative proposal process proceeded quite independently; even the Budget Bureau ceilings did not include new programs. In this area, more top management attention was given, and basic social needs and gaps in program coverage were seriously considered. While cost implications of legislation were frequently estimated, these appeared to have no impact on the parallel budget process. Considerations of priorities among legislative proposals within likely resource constraints were usually ignored.

A second problem was what should one plan for? The Department of Defense has a reasonably integrated program. By and large, the entire defense mission is carried out by the Department of Defense. However, in the Department of Health, Education, and Welfare, this is not so. In education, we account for something on the order of about 10 percent of the funds spent on education in the country; in the field of health, it is only slightly larger. Even for this fractional effort, our activities are indirect. Of our new obligational authority, about 92 percent is in the form of writing checks to state and local governments, school districts, hospitals, universities, and the like to assist their programs. Thus, our problem has generally not been how to operate a program, but how to allocate a relatively modest amount of money to influence the behavior of other institutions in the society. It is a rather different kind of problem from that of Defense; we are faced with partial and indirect influence, lack of planning, and lack of analytical tradition in the professions of education, health, and social service.

What does program budgeting mean today? It does not mean a battery of recognized, understandable, and effective tools of analysis. It is rather two kinds of concepts. First, it is worthwhile to think about our goals and alternative ways of reaching them and to estimate the effects and costs of possible actions. Second, we need to develop a better understanding of what is actually going on.

In the scheduling of our activities, our approach has been to set several levels of resource constraints over time, develop program objectives within these constraints, work out time-phased programs and levels of effort, and develop the budget allocations and legislative programs from the basic plans. With some exceptions (such as categorical compared with general aid to education), our special studies have been exploring preferred means of achieving objectives within the planning framework. This is an iterative process since new information about programs, costs, or benefits can change program priorities and allocations.

A program structure is simply a descriptive mechanism--a classification system by means of which we collect, organize, and present data on the Department's programs in terms of a variety of purpose-oriented dimensions.

To assign a given program of the Department to a particular slot in our classification scheme, we ask a number of questions:

What is the program for?
What does it accomplish?
Who is being helped?
How much does it cost?
Who carries it out (both in the federal government and elsewhere)?
How is it funded?

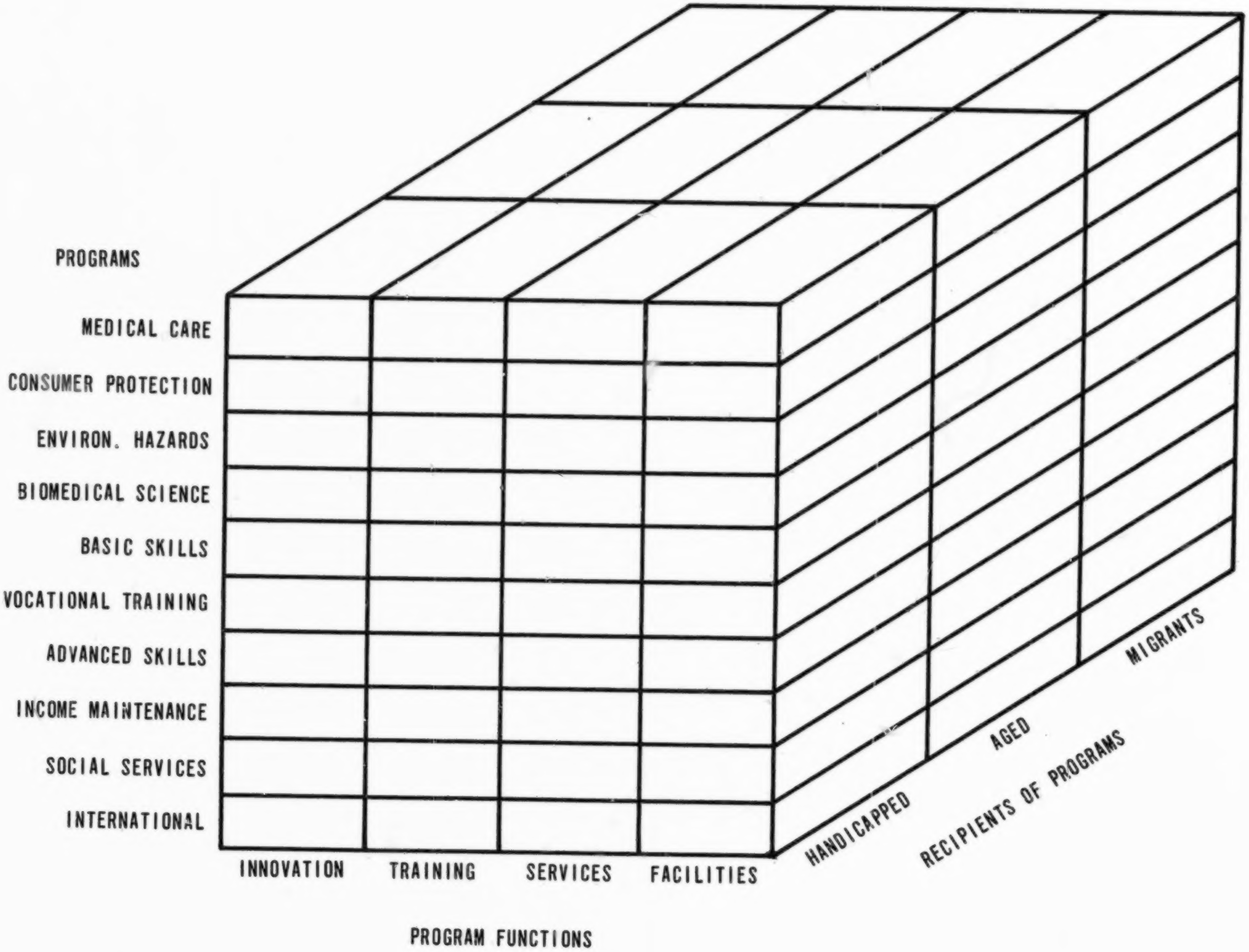
These questions represent the typical questions asked about our programs in the development of budgets. There is obviously nothing remarkable about any of the questions. It is perhaps remarkable that asking them represents something new.

Having classified each program by our answers to these questions, we constructed a multidimensional information system that enables us to look at the total Department effort from a number of angles.

Figure IV-1 gives some insight into the dimensions in which the structure arrays our programs. On the left are names of sample program purposes, such as the provision of medical care, consumer protection,

FIGURE IV-1

A TAXONOMY OF THE PROGRAM STRUCTURE: OBJECTIVES, FUNCTIONS, AND RECIPIENTS


PROGRAMS
MEDICAL CARE
CONSUMER PROTECTION
ENVIRON. HAZARDS
BIOMEDICAL SCIENCE
BASIC SKILLS
VOCATIONAL TRAINING
ADVANCED SKILLS
INCOME MAINTENANCE
SOCIAL SERVICES
INTERNATIONAL
INNOVATION
TRAINING
SERVICES
FACILITIES
PROGRAM FUNCTIONS
HANDICAPPED
AGED
MIGRANTS
RECIPIENTS OF PROGRAMS

development of basic skills, income maintenance, and social services. To answer the question of how these are carried out, each program is subdivided into activities. A sampling of these include innovation, the training of personnel, the delivery of services, and the construction of facilities. For each program we are also interested in the people who are being served--the target populations. Thus, this three-dimensional diagram allows us to look also at what is being done, for example, for the handicapped, the aged, and migrants.

A particular program may appear simply as a cell, or even part of a cell, in the structure. What we are interested in is piecing the cells together to see the relationships of programs to each other as well as their relationships to overall purposes or objectives. Obviously we can determine the totality of medical care for all of the various target groups. Or, we can, with a different focusing of interest, determine what we are doing for a particular target group (say, the handicapped) in all programs (See Figure IV-2).

The program objectives or purposes is only one of many different ways in which one might classify programs.

The program structure consists of the complete set of purpose-oriented categories that describe the programs of an agency. In the Department of Health, Education, and Welfare, we have established a hierarchy of categories to define with varying degrees of specificity the broad goals, specific purposes, and character and orientation of all Department programs.

Program Categories

There are six major program categories: education, health, vocational rehabilitation, social services, income maintenance, and international, as defined in Table IV-5.

Some programs do not fall entirely into one particular category. For example, training programs for nurses might be considered under the category of education or under health. Also, financial assistance for medical care could be considered under either health or income maintenance. In such a case, we have related the program to a single major category (in both of the examples cited, to the health category) but with sufficient identification in terms of lower order descriptors to permit resorting and reaggregation when desired.

Each major program is further divided by major purposes. In education, for example, programs are differentiated among the development of basic skills and attitudes, vocational and occupational skills, and advanced academic or professional skills. Health programs are differentiated among the development of health resources, prevention and control of health problems, and the provision of health services. Table IV-6 shows all of the first and second level categories.

FIGURE IV-2

DETAILED DECISION FOCUS FOR THE PROGRAM STRUCTURE

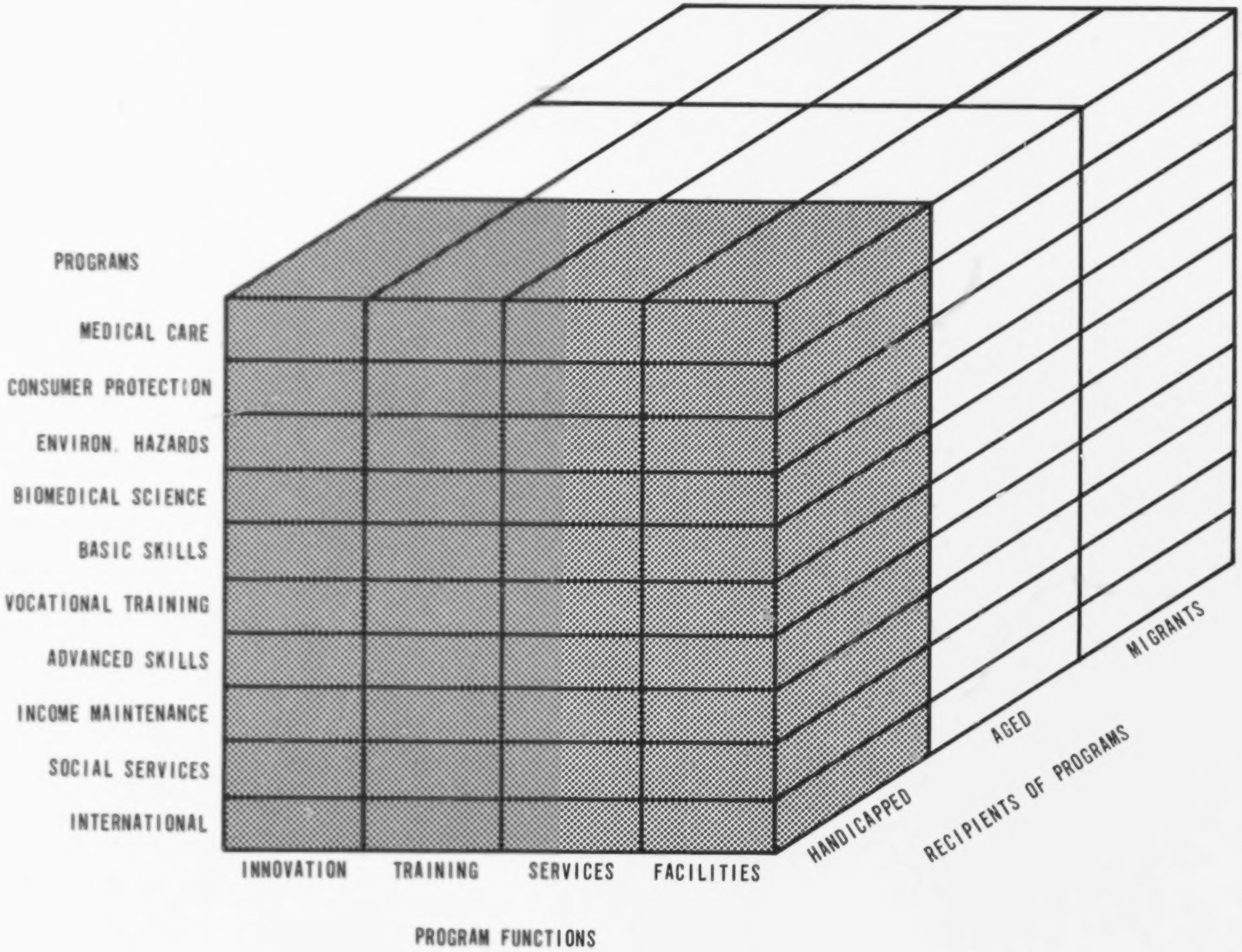

PROGRAMS
MEDICAL CARE
CONSUMER PROTECTION
ENVIRON. HAZARDS
BIOMEDICAL SCIENCE
BASIC SKILLS
VOCATIONAL TRAINING
ADVANCED SKILLS
INCOME MAINTENANCE
SOCIAL SERVICES
INTERNATIONAL
INNOVATION
TRAINING
SERVICES
FACILITIES
PROGRAM FUNCTIONS
HANDICAPPED
AGED
MIGRANTS
RECIPIENTS OF PROGRAMS

Table IV-5

MAJOR PROGRAM CATEGORIES

1. Education

   Programs aimed at assisting in the development of individual skills and attitudes by formal training and education.

2. Health

   Programs concerned with promoting normal physical and mental development and well-being and with repairing or containing the effects of injuries and disease.

3. Vocational rehabilitation

   Integrated programs with both health and training components aimed at helping those who suffer from handicapping conditions to return to productive and gainful employment.

4. Social services

   Programs aimed at assisting individuals and families in social or economic difficulties to function more successfully in our society.

5. Income maintenance

   Public assistance and insurance programs designed to replace in part income that cannot be earned because of age, disabling conditions, or unfortunate family circumstances.

6. International

   Programs whose major purpose is to help citizens of other countries or to support U.S. participation in international organizations.

Table IV-6

DETAIL OF MAJOR PROGRAM CATEGORIES

1. Education
    - Development of basic skills and attitudes
    - Development of vocational and occupational skills
    - Development of advanced academic and professional skills
    - Individual and community development
    - General research
    - General support
2. Health
    - Development of health resources
    - Prevention and control of health problems
    - Providing health care
    - General support
3. Vocational rehabilitation
    - Rehabilitation for disabling conditions
    - General support
4. Social services
    - Improving the social functioning of adults
    - improving the social functioning of the child and family
    - Improving the organization and delivery of social welfare services
    - General support
5. Income maintenance
    - Aged assistance
    - Disability assistance
    - Other individual and family support
    - General support
6. International
    - Bilateral activities (Department of State)
    - Bilateral activities (AID)
    - Bilateral activities (other)
    - Multilateral activities
    - General support

Within each of these broad purposes, subcategories have been established to illuminate the more specific purposes of the programs.

Take, for example, the complete set of subcategories defined for the education area. Education programs are described in five different dimensions:

1. Major category: Education
2. Educational goals: The broad purpose of education
3. Program objectives: The purposes of federal action
4. Program character: The nature of federal action
5. Educational level objective: The educational or governmental level initially affected (as distinct from the ultimate beneficiary)

Educational goals are specified in Table IV-7 and program objectives are shown in Table IV-8. Program character is defined in Table IV-9.

The educational impact level shown in Table IV-10 allows us to view federal programs in terms of the educational level initially affected by the influx of federal funds. This level is frequently different from the level ultimately affected, as in the case of a program of graduate followships for prospective elementary school teachers.

Table IV-11 shows a proposed 1968 budget for vocational education in program structure categories sorting on educational level. A program such as Prospective Teacher Fellowships, would be related to the program category structure as described below.

As Figure IV-3 shows, this program is under the major goal Education and is more specifically subclassified under the ultimate educational goal of Developing Basic Skills and Attitudes. Its character is to "upgrade quality of the educational system" with initial impact at the graduate level. We use the codes shown as shorthand for describing this assignment of the program to the various categories.

Across the bottom of Figure IV-3 is the simultaneous classification of the program under the more traditional budget structure. This cross-coding permits us to translate our program plans into an annual budget request automatically. There is other information we want to obtain about the program, such as:

- The target group, or ultimate beneficiary (in this case elementary and secondary school children).
- The recipient of the federal funds.

Table IV-7

EDUCATIONAL GOALS
(Broad Purpose of Education)

1. Development of basic skills and attitudes
2. Development of vocational and occupational skills
3. Development of advanced academic and professional skills
4. Individual and community development
5. General research
6. General support

Table IV-8

PROGRAM OBJECTIVES
(Purposes of Federal Action)

1. Improving the education of the general population
2. Improving the education of the disadvantaged
3. Improving the education of the handicapped
4. Improving education for international understanding

Table IV-9

PROGRAM CHARACTER
(Nature of Federal Action)

1. Increasing the resources of educational institutions
2. Upgrading the quality of the educational system
3. Developing and introducing innovation
4. Collecting and improving educational statistics
5. Furthering equal educational opportunities (civil rights)
6. Acting on the social environment

Table IV-10

EDUCATIONAL IMPACT LEVEL
(Initial Impact of Federal Action)

1. Preschool, elementary, secondary, and local agency levels
    a. Preschool
    b. Elementary and secondary

2. Postsecondary and higher education levels
    a. Postsecondary vocational
    b. Junior college
    c. Other undergraduate

3. Adult, general education, and library levels
    a. Adult basic
    b. Adult vocational
    c. Public library

Table IV-11

DEVELOPMENT OF VOCATIONAL AND OCCUPATIONAL SKILLS
Proposed Budget for FY 1968
(Millions of Dollars)

	R&D	Demonstrations Testing	Training	Services	Other	Total
Secondary						
Improving education of general population						
Increasing resources	$--	$--	$-	$119	$--	$119
Upgrading quality	--	--	3	--	20	23
Improving education of disadvantaged						
Increasing resources	--	--	-	4	--	4
Subtotal	$--	$--	$3	$123	$20	$146
Post secondary and junior college						
Improving education of general population						
Increasing resources	--	--	-	61	--	61
Upgrading quality	--	--	1	--	3	4
Improving education of disadvantaged						
Increasing resources	--	--	-	2	--	2
Subtotal	$--	$--	$1	$ 63	$ 3	$ 67
Adult						
Improving education of general population						
Increasing resources	--	--	-	30	--	30
Upgrading quality	--	--	2	--	14	16
Improving education of disadvantaged						
Increasing resources*	--	--	-	158*	8*	166*
Upgrading quality	6	--	-	--	--	6
Subtotal	$ 6	$--	$2	$188	$22	$218
Other						
Improving education of general population						
Upgrading quality	9	35	2	--	1	47
Total	$15	$35	$9	$374	$46	$479

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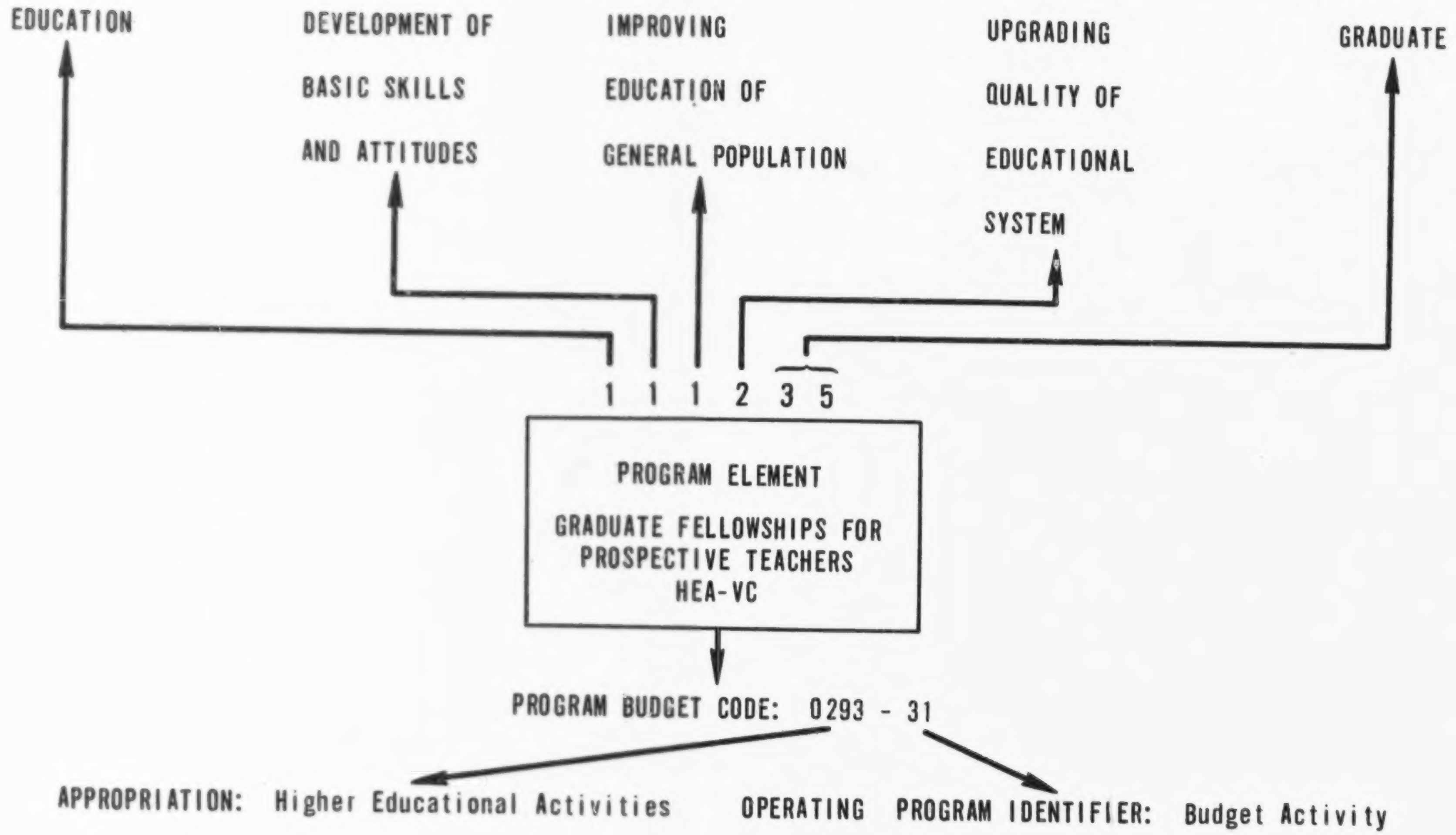
* Department of Labor manpower development and training activities; allocation to HEW

FIGURE IV-3
PROGRAM CATEGORY CODE


EDUCATION
DEVELOPMENT OF BASIC SKILLS AND ATTITUDES
IMPROVING EDUCATION OF GENERAL POPULATION
UPGRADING QUALITY OF EDUCATIONAL SYSTEM
GRADUATE
1 1 1 2 3 5
PROGRAM ELEMENT
GRADUATE FELLOWSHIPS FOR PROSPECTIVE TEACHERS HEA-VC
PROGRAM BUDGET CODE: 0293 - 31
APPROPRIATION: Higher Educational Activities
OPERATING PROGRAM IDENTIFIER: Budget Activity

- The organizational unit in HEW responsible for the program.

- The legislative status and mode of financing the activities.

Also, we want to know how the purposes of the program are accomplished--what are its activities? Major activities as shown in Figure IV-4 include such things as research and development, demonstration and testing, training of personnel in HEW-related occupations, provision of services, and information.

In our example, the major activity is "training of personnel." In this case, we ask further "what sorts of persons are being trained" to gain some idea of the contribution made by the Department programs toward increasing and upgrading manpower in health, education, and welfare-related areas. This is shown in Figure IV-5.

And, most importantly, we demand and eventually will get descriptions and measures of program outputs.

As one may surmise, there are indeed many blanks in this area, and filling in the blanks is not an easy task. Even the straightforward part--the expenditures by purpose--has problems.

Such expenditures ought to reflect incremental resources devoted to the purpose in question. But the number recorded here is a total that may increase or decrease with changes in many sectors of the economy. Because the federal contribution is, in most cases, only a part of total resources devoted to a purpose, any change in the federal share may occasion increases or decreases in the resources devoted to the prupose by others--the states, municipalities, or the private sector of the economy. Take, for example, the results of a federal program to demonstrate the efficacy of cervical cancer detection methods. Many women may be persuaded to have annual examinations at their own expense, and voluntary organizations may cooperate by mounting extensive screening programs. Or, conversely, a new federal program for aid to elementary schools may allow local school boards to defer an increase in school expenditures financed from local taxes.

Finding out what was purchased is sometimes much more difficult than knowing where the funds are used, for whom, and for what purposes. For some programs, it is virtually impossible, and attempts at defining an output are a sheer waste of time. I would so classify most research expenditures and funds for programs to promote innovative practices. This spending is money in search of the answers to problems. In most cases, it does not buy the answers; it buys the time of people willing to look for them.

In most programs, however, it does make sense to seek outputs. Unfortunately, those outputs most easily identified usually are not connected in any obvious way with the objectives of the broader program of which they are a part. It is not difficult to count, for example, the additional number of nurses trained in a program. The relationship between

FIGURE IV-4

MEASURES OF PROGRAM ELEMENTS REPORTED BY FISCAL YEAR

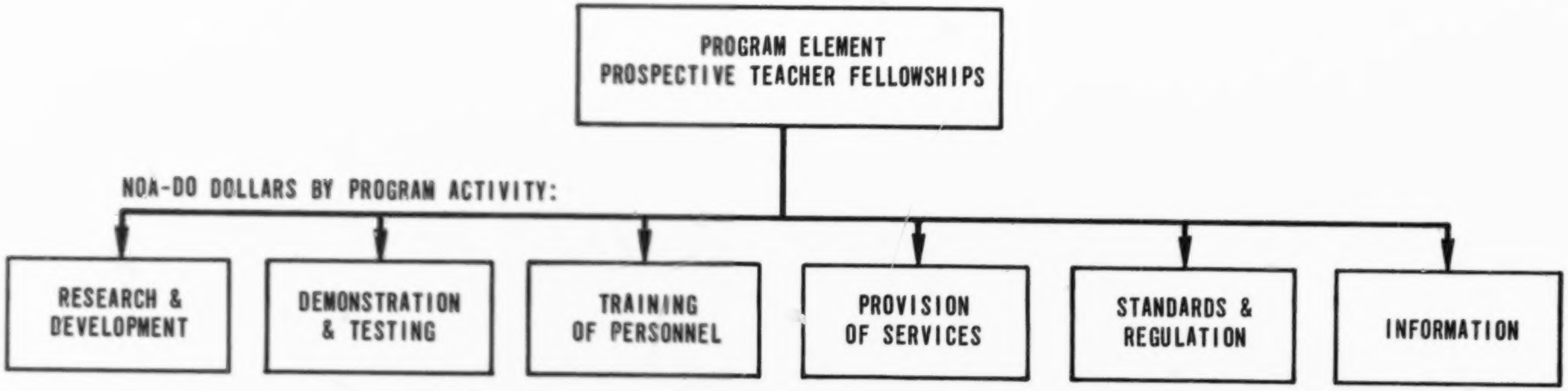
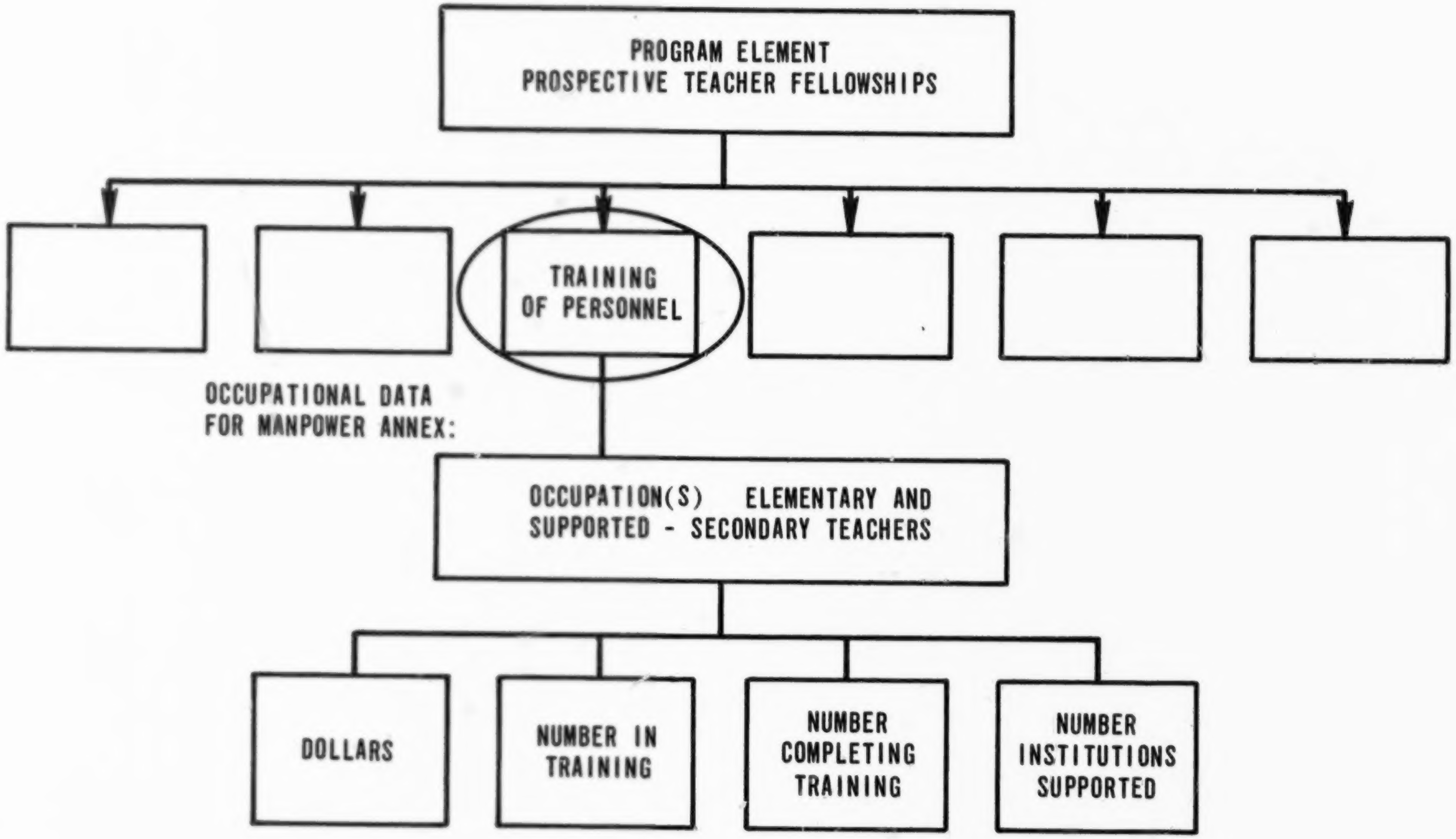

PROGRAM ELEMENT
PROSPECTIVE TEACHER FELLOWSHIPS
NOA-DO DOLLARS BY PROGRAM ACTIVITY:
RESEARCH & DEVELOPMENT
DEMONSTRATION & TESTING
TRAINING OF PERSONNEL
PROVISION OF SERVICES
STANDARDS & REGULATION
INFORMATION

FIGURE IV-5

PROSPECTIVE TEACHER FELLOWSHIPS: TRAINING OF PERSONNEL


PROGRAM ELEMENT
PROSPECTIVE TEACHER FELLOWSHIPS
TRAINING OF PERSONNEL
OCCUPATIONAL DATA FOR MANPOWER ANNEX:
OCCUPATION(S) ELEMENTARY AND
SUPPORTED - SECONDARY TEACHERS
DOLLARS
NUMBER IN TRAINING
NUMBER COMPLETING TRAINING
NUMBER INSTITUTIONS SUPPORTED

that increment and the health of the nation is not readily discernible, however, since the contribution of nursing services to health can only be assessed in the context of the other determinants of health, and the larger model to do this has not yet been developed.

While the information system yields useful insights into programs, federal program costs and immediate outputs such as numbers of students trained are insufficient guides to relative priorities. It is necessary to analyze the social costs and benefits of programs and alternatives. In the area of improving people's abilities to earn income, we have analyzed such programs as adult basic education, MDTA, vocational rehabilitation, work experience training, and vocational education. Our Program Analysis papers, one of which is on Human Investment Programs and covers Adult Basic Education and Work Experience Training, were published in September 1966 and are available on request from the Department.

With respect to secondary vocational education, two questions were addressed in the above study: (1) Does the type of high school education completed--regular or vocational--make a significant difference in post-high school earnings? and (2) If so, are these benefits sufficient to justify the additional costs?

Measuring Benefits

The usual measure of success in vocational education in placement of the student in the type of job for which he has been trained. This measure, however, does not tell us whether the program was worth the cost. The student might have found the same job or an equally attractive one without vocational education. To obtain a measure of the economic benefits of the program that can be compared with its costs, earnings of vocational education graduates may be compared with those of comparable noncollege-bound graduates who do not have vocational education.

No national data exist on the posthigh school earnings of vocational and nonvocational students. A few studies, however, yield fragmentary information. Three studies that we examined showed the differences in initial earnings of a vocational graduate compared with those of his regular high school counterpart ranging from 0¢ to 28¢ an hour.[31,32,33]

On the basis of this information, it was assumed that the initial wage advantage of the vocational graduate is 15¢ an hour, or $300 per year. This estimate is a guess that, if anything, would tend to overstate the benefits to be expected. It was assumed that the annual income advantage of $300 remains constant over time. The question was: How many years? At present, there is no data on the time pattern of earnings streams of the two kinds of graduates. An individual might be expected to change occupations two or three times in his life and he will frequently have to update or even relearn skills required in his job. It is possible that the initial advantage of the vocational graduate disappears when these changes take place. The only longitudinal study available suggests that "the vocational graduates have an initial advantage in terms of earnings progression but within six years after graduation the advantage swings in favor of the academic graduate and tends to become even greater in the following years . . . thus, over a period of about ten years the academic graduates tend to overcome their earnings disadvantage of the early years at work."[31]

In the absence of other information, it was decided to compute the benefits of vocational education on the basis of two assumptions: (1) that a constant income differential continues over 10 years and (2) that a constant income differential continues over 20 years. However, 10 years, or even five years, would seem to be a realistic estimate of the period for which an earnings differential attributable to vocational education would persist.

Measuring Costs

The average costs per graduate of vocational and technical education depend on the number of years in which the student is enrolled in the program and the average annual cost per pupil offered such training. The student can be enrolled in a vocational and technical education curriculum for one, two, three, or four years depending on the requirements of a particular program. Given the current state of knowledge about vocational and technical education, these costs can only be approximated.

Estimates of the additional annual per pupil expenditures attributable to vocational education range from $200 to $700. Several studies have found vocational education costs to be anywhere from 50 percent higher to about double the costs per student in nonvocational high school curricula.[31] Our analysis assessed the additional cost of vocational education to be between $400 and $500 per year and assumed that the typical student averages three years in a vocational curriculum. This is a conservative estimate because opportunity costs and direct private costs are ignored.

Benefit/Cost Ratios

The tabulation on the following page shows benefit/cost ratios for vocational education under several alternative assumptions. These benefit/cost ratios are more than 1, but they are markedly lower than the ratios found for most other programs analyzed. For example, vocational rehabilitation appears to have, on the basis of the data we have, a benefit/cost ratio that ranges between 12 and 13 to 1. Adult basic education appears to have the potential of a benefit/cost ratio of about 11 to 1, as opposed to 1.5 to 1 for secondary vocational education. When you look at all of

Cost per Year	Total Cost of Training per Student	Average Annual Increases in Earnings	Benefits per Graduate*	Benefit/ Cost Ratio
		Assuming Constant Benefit Over 10 Years		
$400	$1,200	$300	$1,970	1.6
500	1,500	300	1,970	1.3
		Assuming Constant Benefit Over 20 Years		
400	1,200	300	3,505	2.9
500	1,500	300	3,505	2.3

these, the claims of vocational education seems to be very modest when competing for the dollars of the Department† (see Table IV-12).

Alternatives to Secondary Vocational Education

The aims of secondary vocational education may be more efficiently achieved by forms of training other than formal vocational education. Although insufficient data are available to make statements that are more than suggestive, the alternatives are worth considering.

Within the existing secondary vocational education program, more vigorous activity by school sources and state employment agencies to assist placing the graduates may be as rewarding as concentrating on additional training. Acceptance of the primary responsibility for entry job placement by high schools would provide a bridge between high school and work for the noncollege-bound individual similar to the one that now exists between high school and college for the academic graduates. Another possibility is the revamping of vocational curricula to emphasize on-the-job training. On-the-job training could be included in the student's high school curriculum or might supplement a general high school curriculum. This is essentially the case in the cooperative work-study programs now operating in some high schools.

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* Discounted at 4 percent.

† Editor's note:

The Department of HEW obtained benefit/cost ratios of $1,351 for each dollar spent for a seat belt education safety program, and a cervical-uterine cancer screening program showed a 9 to 1 benefit/cost ratio. Arthritis showed a 42 to 1 benefit/cost ratio. Table IV-12 shows these results as reflected in Business Week of January 21, 1967. Some of the discussion following Dr. Grosse's presentation was concerned with whether it is appropriate to compare the benefits and costs of such programs in health with those for vocational education in arriving at fund allocation decisions within HEW.

Table IV-12

RESULTS OF SELECTED HEW CAMPAIGNS

	Cost (millions of dollars)	Potential Savings in Lives	Dollars		
			Cost per Life	*Total Savings (millions)	Savings per $1 Spent
Highway accident campaign					
Encourage the use of seat belts	$ 2.0	22,930	$ 87	$2,728	$1,351
Promote chest and shoulder-belts	.6	5,811	103	681	1,117
Educate accident-prone pedestrians	1.1	1,650	666	153	144
Encourage motorcyclists to use helmets and eye shields	7.4	2,398	3,336	413	55
"Don't drink and drive" campaign	28.5	5,340	5,824	613	21
Medical screening program for driver licensing	6.1	442	13,801	23	3
Disease campaigns					
Cancer					
Cervical-uterine cancer	118.1	34,200	3,470	1,071	9
Breast cancer	22.4	2,396	7,663	101	4
Head and neck cancer	7.8	268	29,100	9	1
Lung cancer	47.0	7,000	6,400	268	5
Arthritis					
Treatment centers, clinics, professional education	35.0	--	--	1,489	42
Syphilis					
Expand blood screening efforts	179.3	11,590	22,252	2,993	16
Tuberculosis					
Step up research and control	130.0	5,700	22,807	573	4

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* Direct and indirect savings through earning power of individuals.

Source: Department of Health, Education, and Welfare

Imaginative school curricula, combined with experience and training in a real work situation, might yield major increases on the benefit side, although there is as yet no evidence to support this suggestion. On-the-job training might also serve to reduce costs by relieving schools of the necessity of acquiring expensive equipment that becomes obsolescent and is utilized only a fraction of the week.

Conclusion

The most immediate conclusion is that more and better data are needed on all phases of the vocational and technical education program. A second conclusion suggested by the results is that there is an urgent need to revise the existing vocational and technical education program. The various segments of analysis indicate:

1. That at the secondary level, the present vocational education program, when compared with general education, does not seem to be a high return investment. This conclusion might be changed, however, if the program has a significant impact on prevention of dropouts.

2. That many other attractive alternatives to the existing forms of vocational education (on-the-job training, placement policy emphasis, apprenticeship programs, to name a few) exist and should be looked into before expansion of the vocational education program takes place.

Taken by themselves, these results do not support a substantial expansion in vocational education along existing lines. Expansion of the vocational education program should be contingent on a set of recommendations outlining new directions that promise marked increases in the effectiveness of vocational education.

When the U.S. Office of Education suggested large increases in the budget for secondary vocational education last year, we were unwilling to agree to these on the basis of evidence of payoff. We did, however, suggest substantially increased research on vocational education to see what can be accomplished by exploring alternative approaches.

Mr. Kotz:

May I ask one question on the benefit/cost ratio, and then open the discussion for comments and questions from the rest of the group? One of the purposes expressed in the legislation is that it should provide training to help the disadvantaged to enter the mainstream of economic life. The cost of working with the disadvantaged would be higher and the income stream would be lower, so you are certain to have a lower benefit/cost ratio. Now, in this kind of consideration, if you just relied on a benefit/cost ratio alone, that would rule out some of these programs of training to help the disadvantaged. Do you really want to do so?

Dr. Grosse:

If you were only looking inside vocational education, this might be true. But if what you were looking at is: "how do you assist the disadvantaged to gain higher incomes, or a better quality life?" it seems to me not unreasonable, having selected the disadvantaged for analysis, to examine the payoffs from vocational education in a formal sense compared with other means of giving them vocational training and with other things you might do for them, such as giving them food or money. If you are sure what you want to accomplish for the disadvantaged, I think benefit/cost analysis will help. If what you say is: "I want to improve the world by vocational education, and where can I get my biggest return for a buck?" you may get answers that do not help, if your real problem is disadvantaged children.

Mr. Kotz:

But then would you include that lower benefit/cost ratio for the disadvantaged in with your overall ratios that you showed on your chart? It would tend to lower the overall ratios for vocational education if you include the benefits and costs for the disadvantaged with what is being done, say, for technicians or the advanced data processing or business education graduates, so that there has to be some caution exercised to avoid comparing apples and oranges.

Dr. Grosse:

Yes, absolutely.

Mr. Michael:

You mentioned benefit/cost ratios for different areas. You mentioned cervical cancer, for example, and a 1,000 to 1 ratio as the payoff. Vocational education did not show up very well in comparison. And yet, I wonder, in looking at cervical cancer, if you might need large numbers of medical technicians. The benefit/cost ratio for these relatively low paid people might be even lower. In other words, the question is: "What do you include in benefits?"

Dr. Grosse:

And what do you include in costs? A large part of the cost of the cervical cancer program is the training cost for cytologists to do the analysis in the laboratory. So I think it was reasonably well handled. But I did not mean to say that we ran around and looked at the benefit/cost ratios and made up a program. A program that seems to pay off a dollar and a half for every dollar invested may look good, but it is not as good when compared with another program with better payoffs.

Dr. Arnold:

Dr. Grosse, obviously in this study, there are a series of assumptions that have been made. Is it possible for us to find out what those assumptions are?

Dr. Grosse:

Are you talking about the assumptions that led to the numbers on vocational education?

Dr. Arnold:

Yes.

Dr. Grosse:

Yes, I think Bruce Davie's paper references you to the studies we looked at, and I believe that within those studies their assumptions are reasonably stated.

Dr. Worthington:

Where do you get the three years of training? The programs vary considerably from state to state.

Dr. Grosse:

That is right. This is what it would cost if there were three years of training, and my recollection is that these students had been exposed to approximately three years of vocational training. This was not a survey of what is going on nationally. It was squeezed out of the few studies last year that gave us insights into costs and benefits.

Dr. Arnold:

Isn't that a pretty tenuous thing on which to make a decision as to the future funding of vocational education?

Dr. Grosse:

Less tenuous than the way decisions were made in the past, I think.

Mr. Kotz:

Dr. Grosse, is one of the assumptions you are making here that we have received increased federal support for vocational education to this point, and now further demonstration is required of its value? Or that people in vocational education must demonstrate its worth before further increases are made in the amount of federal funds for it?

Dr. Grosse:

That is the way the issue actually is presented. The problem was: "Here is a program that has come in and said it does very fine things for society and it can effectively spend considerably more money than is currently in the program." What our study did was to ask this question of this and other programs: "What light does that seem to show on what we get out of marginal expenditures for these purposes as opposed to doing other things with the money?" We are recommending putting more money into research--not to get at the value of vocational education but to develop programs where the payoff would be even higher.

Dr. Arnold:

Now, may I ask another question, is there any calculation made as to what the unemployment rate applied to those people might have been?

Dr. Grosse:

I think the answer is no. I think we certainly have to ask what the rate is, which helps us arrive at these conclusions. What we are really doing is trying to force the level of examination of the programs into the context where you will try to structure the inputs into the decision-making processes that will bring these questions to the surface and indicate whether they really are pertinent or not.

Dr. Hardin:

I would like to ask one question. Is 4 percent the discount rate you are using? Is that a policy within HEW as to the discount rate or did you mention this as an illustration?

Dr. Grosse:

No, it was purely illustrative. What we did was to estimate these things at varying discount rates to see whether, not knowing what was an appropriate discount rate, there were significant differences in the relative positions of programs if we had assumed varying interest rates.

Dr. Hardin:

Why not assume a 10 percent rate then?

Dr. Grosse:

With the 10 percent rate, the program looked less attractive. What I took was the lowest discount rate other than zero that we had counted.

Mr. Kotz:

Unfortunately, the only widely promulgated interest rate that I know in the federal government is lower than 4 percent; it is 3-1/8 percent used in waterway projects.

Dr. Thomas:

How did you figure the financial benefit of the cervical cancer program?

Dr. Grosse:

In the case of the medical program, we started with estimates of the difference it would make in the number of deaths per year as a result of promoting the program and the differences in the numbers of those suffering disability, or crippled in the case of arthritis programs. To make those facts over into a benefit/cost ratio that was commensurable with vocational education required estimating the average earning capacities of the people of the particular ages. I would not want to hold that this is a very meaningful number, but it was at the end one of many clues that we looked at.

Dr. Stromsdorfer:

Within this overall broad agency of HEW, you can make comparisons between different health programs, different education programs, and different welfare programs. You are on much more tenuous grounds when you compare these three broad programs that essentially are designed to accomplish different things. You must realize that even if the benefit/cost ratio of teaching people to wear seat belts is 1,000 to 1, clearly when you compare it with the benefit/cost ratio of vocational education of 2 to 1, you are comparing--if not apples with oranges--at least Florida oranges with California oranges, and you may not have the same product.

Dr. Worthington:

As a State Director of Vocational Education, I have been concerned with the President's budget message. He said the vocational work-study provisions of the Vocational Act of 1963 should be supplanted by Neighborhood Youth Corps. He said that his budget advisers recommended that. Would you, as a budget expert, tell me how he determined that he should eliminate this vocational work-study program?

Dr. Grosse:

I do not know the substantive answer to that. We did not do any analyses of work-study in vocational education to my knowledge.

Dr. Worthington:

I assume that somebody in HEW concurred with the recommendation, because the President included nothing for vocational work-study to help keep the vocational students in school which to us in New Jersey is a very important program. I just wonder how he determined that the NYC should replace the work-study program, which is not a three-year program. Your 1.6 to 1 ratio would be unfair because it is a special program to keep youths in school.

Dr. Grosse:

I would just like to say there is a very practical answer to that, and I think there is a differential in compensation between work-study and NYC. It is a practical political problem that I think Congress has to think about.

Dr. Worthington:

The administrative cost for work-study is less than 5 percent. The NYC administrative cost is ten times that.

Mr. Bowen:

This type of decision-making is used in business and is very rational. But I wondered what you are doing with respect to individual sector comparisons of various aspects of vocational education. Technician education is of great interest to industry, as you know, and it is interested in obtaining trained and highly skilled persons. I wondered how much further you were pushing such analyses, particularly in view of the fact that the previous speaker, Dr. Mangum, apparently made no reference to the use of these techniques for evaluating the Vocational Education Act of 1963. My question is: "What is being done for intra-sector comparisons in vocational education?"

Mr. Kotz:

They are not being ignored, but adequate and meaningful information has not been collected, analyzed, or displayed by vocational educators in this area to date. Some say the data are available, but not collected. If so, some special efforts to collect, organize, and evaluate them should be made on a high priority basis.

Dr. Arnold:

The data are there for technical education. We have not used it inside our shop and I am not sure we would know how right now.

Mr. Kotz:

You are assuming that the data are there for technical education, in terms of all the costs and all the benefits?

Dr. Arnold:

I think so.

Mr. Bowen:

An Advisory Council has been established to evaluate the Vocational Education Act of 1963 by the end of the year, and report to the Secretary of the Department (HEW) and the President. Without this type of data collection, I do not see how the Council can realistically evaluate it or evaluate it in keeping with the Executive Directive.

Dr. Fishman:

Dr. Grosse, where would you draw up the boundaries for determining your benefits? Would you include, perhaps, such things as the savings attributable to a reduction in juvenile delinquency or crime?

Dr. Grosse:

Conceptually, I think the impact of your question is that there is no boundary in concept to these. I think what it comes down to is a practical kind of question. What one does is look at programs of various sorts under varying assumptions and with various criteria. You try to ascertain from these clues whether the program, relative to other things you might do, is better, worse, or indifferent. If you can get insights as to the impact on juvenile delinquency, whether they result from data or professional judgment, you use them. So I would say in general, we try not to draw the boundaries. In practice, we do not have the models that permit us to make these interrelationships so if we find, for example, a program that seems to be doing very well relative to another program, we try to look at the program that is not doing very well (analytically) to see if we can extend its indirect implications to shore it up.

Mr. Kotz:

Dr. Arnold, there is a man by the name of Wildavski who has written about the politics of the budgetary process and who suggests that there is a certain gamesmanship in obtaining funds from government that requires careful attention to strategy. Instead of letting Dr. Grosse's office get hold of the T & I study, as the first approach, you might have started analysis of benefits and costs with technical training and demonstrated a much higher payoff. So you might come out with a different ratio. Of course, only a valid benefit/cost study of technical training would prove this hypothesis one way or another.

Dr. Kelly:

We are going to get into a "federal syndrome" here. We will be thinking of all the analyses, all the costs, and all the benefits, aggregated and accrued at the federal level. The truth of the matter is, as Dr. Grosse pointed out, that federal contributions to education are so small that historically I think it is questionable whether they have really significant impact on American education. We have had a lot of change and a lot of growth in education without much coming out of the federal government. The point is that there is a lot going on at the local and state levels. I would like to hear Dr. Grosse comment about how likely it is that this kind of economic analysis will sift down to the levels where most of the resources are being allocated?

Dr. Grosse:

To underscore your point, I think that the federal government today is trying to move more and more of the decision processes to the states. We are trying to develop consolidations in the area of health, education, and social services of that nature. So, in estimating the costs and benefits of the programs, we are not restricting ourselves to the federal dollar, but are concerned with the social costs as far as we can measure them and the social benefits. We then use these to evaluate the programs in terms of allocating federal dollars to them. With respect to your specific question that has to do with the states, counties, cities, and universities, there is considerable motion in the area, going under the banner of program budgeting and other similar titles. Most of the interest that I have run into has been at the level of the governors who are concerned with cutting costs and gathering information. But school boards, for example, are beginning to ask questions on what this means to them, both from the point of view of the utility of analytical approaches and also from the point of view of the danger--not only danger of poor decisions, but also the danger of being inundated with requests for information. This affects somebody else's good or bad analysis. I am reluctant to initiate large scale data collection. When people try to convince me, I want to understand what we do with the data when we have them. I am reluctant to encourage local communities to mimic the federal structure, thinking that it gives them some tool to analyze programs in a meaningful way. What we are trying to do now in various ways is to keep the lines of communication open between people like those in our office and in various other government agencies and universities, and local officials who are interested. We may, out of that interchange, learn what to do. Actually, in setting up the program structure of the Department, we started with not how we should look at HEW, but how we should look at education, and health, and so on, with the idea that we want to build an information system that could use information from these other areas. Again, to underscore what I said at the very beginning, we do not have a technology that is transferable. What we have is an approach that says one should ask rational questions, be concerned with trade-offs, and estimate or at least have some idea of what we are accomplishing with the program.

Dr. Spiegelman:

I would like to say something, as being, I suppose, the only one here that knows nothing about vocational education, so I can talk more freely than others. But it seems to me, and I'll just throw this out as a devil's advocate rather than as a position that I'm going to prove and hold, but it is something to think about, that vocational education, of all the kinds of programs involved, is the one that would be most clearly identified with an efficiency criteria as its main objective. I have not thought about this, so if you throw it back to me I would appreciate it but I find it hard to see other major objectives or other major goals, other than that of equity or of economic efficiency that vocational education (and I emphasize the vocational part of it) should have.

Mr. Kotz:

If you were starting anywhere in the educational spectrum and applying benefit/cost analysis, I think vocational education would be the area for the reason that the heavy emphasis on gainful employment can be measured in economic efficiency terms. But there is the additional stress in the current legislation and in the Manpower Act on training the disadvantaged. This conflicts with economic efficiency, since costs of training for the disadvantaged may be higher than for middle class, higher motivated students and benefits may be lower, unless you bring in savings that may result from reduction of juvenile delinquency, crime, unemployment, and the like.

These two categories of objectives are primary. But I think we should be aware that there are other objectives of the educational process, as earlier discussed and political constraints as well as significant legislation at state and local levels. The federal government is not the only one that has its inputs into this decision-making process.

Mrs. Garfield:

What is a trade-off?

Dr. Grosse:

What I meant was taking money out of one program and putting it in another to see how much better off we were in one and how much worse off we were in the other, with some concept that maybe there was a way of moving money among programs so that the highest good was served jointly.

Mr. Kotz:

In your terms, would you do better to put the money, say, into secondary education in general, with a comprehensive arrangement, than separate vocational schools? What would be the return in terms of benefits and costs of one approach rather than the other? It would be easier than comparing, I think, seat belts with vocational education.

Dr. Grosse:

Correct. Another example would be if you wanted to increase the quality of teachers, whether you would do better by giving scholarships to train them or raising salaries.

Dr. Arnold:

As I read these papers, I seemed to see more and more need for vocational educators to become trained in the techniques of benefit/cost analysis, not because they need to defend themselves so particularly, but to be sure that these various considerations and criteria are entered in. There are not, enough people who are steeped in the program and who see all of the aspects of it. Is it practicable that vocational educators could be trained in these techniques?

Mr. Kotz:

You recall earlier I mentioned the need for the interdisciplinary approach. There is no reason for you to devote your time to becoming an economist and diverting your valuable efforts from performance of operating duties. What you need on your staff are the planning and analytical capabilities. You need economists, systems analysts, vocational educators, and other specialists on an interdisciplinary team working together. You need the vocational educator or the educator at the secondary level or higher education level working with this team arrangement. You need the individual skilled in educational technology.

Dr. Arnold:

To get off the economic efficiency objectives and go to others, it seems to me it is almost necessary that you have some vocational educators around to get a searching examination of some of those objectives that you listed (SRI Reconnaissance Surveys objectives).

Mr. Kotz:

That is correct, and I think we should recognize that there are not enough data now available to make intelligent judgments or choices in these areas, so that a great deal of intuition and subjective judgment will be used. One of the things that can be done is get an increased analytical capability focused sharply on the planning and programming of education, and that is what this conference has been about today. I think we have come out with a very clear agreement that this is essential.

Chapter 13

BUDGETING FOR VOCATIONAL-TECHNICAL EDUCATION

by

Thomas G. Fox

Financial support of vocational-technical education has increased at all levels of government over the past few years. As vocational-technical education enrollments expand, previous budgeting procedures may no longer suffice and remain consistent with a social objective of efficient resource administration. This paper surveys current school budgeting practices for selected school systems and states. A brief discussion of vocational education decision-making is then presented. Having examined some current budgeting and decision-making procedures, it seems apparent that some changes in school budgeting techniques would lead to greater efficiency in the use of educational resources.

Current Budgeting Practices

Those familiar with the early Taft Commission's recommendation concerning performance budgeting, the Hoover Commission's recommendations of 1949, and the efforts of RAND specialists to develop program budgeting can hardly help but be critical of conventional government budgeting practices. Conventional budgets are typically annual in nature, emphasize types of resources to be purchased, and show no attempt to relate objects of expenditure to outcomes of the production process. Although we are now considering vocational-technical education budgeting, the relative magnitude of vocational-technical education activities in K-12 public school systems is quite small.

Discussing and evaluating current educational-technical education budgeting practices is somewhat hazardous. Budgeting procedures employed by the 50 states and thousands of local school districts are anything but homogeneous. As an art and an administrative tool, budgeting is highly developed and applied in a few states and school districts. Other state and local governments tend to view the budget and budgeting process as a necessary accounting operation that is not closely related to administration of operations.

Before attempting to evaluate budgeting for vocational-technical education, a brief discussion of useful budget characteristics might be helpful. Then the display format generally used by the "typical school administration" is considered. All comments will be strictly applicable to the typical school administration but will require slight modification in all other cases.

Useful Budget Characteristics

A useful budget structure should contribute to program analysis and the search for the best use of resources to achieve the objectives of the organization. This suggests that the budget should provide summarized, pertinent data for administrative decision-making. The budget should be oriented to relate resources used with expected accomplishments. And alternative means for achieving slightly modified objects should be considered.[33] These characteristics apply to budgets used for administrative decision-making, not to peripheral budgets designed merely to comply with state laws.

Conventional Budget Format

The structure of conventional government budgets--at least in the United States--has evolved with major emphasis on comptroller requirements. This structure is designed to elicit fiscal accountability and to preserve the identity of legislative appropriations. The conventional budget emphasizes objects of expenditures--government purchase such as those of typewriters and personnel services. The line item budget does not focus on the services that government units provide and is therefore of little use to program planners and decision-makers.

It is difficult to overemphasize the importance of the structure of the budget and the way information is displayed. According to Burkhead, "classification is the structural key to conscious and rational government . . . . The purpose of budget classification is to help focus the questions and to clarify and detail the answers."[34]

Usually at least four methods of classifying budget data are recognized: by object of expenditure, by function, by organization unit, and by performance unit. The first two methods of classification are almost always encountered in educational budgeting, and frequently a variant based on organization level is employed. One rarely, if ever, finds that a performance classification is also utilized in educational budgeting. Table IV-13 displays an illustrative budget for a single organizational unit--an area vocational-technical school--with information classified by function and object of expenditure. In most states, the final format of the budget is specified by state education departments.[35]

Typically, each function is supported by a line item classification of expected expenditures for personnel, materials, supplies, and so forth. If information is also arrayed organizationally, say, as elementary schools, adjustment centers, comprehensive high schools, and vocational high schools, the budget is said to be classified by organizational unit. For many school systems, the same budget document displays expenditure data of function, by object of expenditure, and by organizational unit.

This format allows for gross evaluation of changing functional distributions of expenditures over time. But, empirically, little change

Table IV-13

ILLUSTRATIVE EXPENDITURE BUDGET FOR AN AREA VOCATIONAL-TECHNICAL SCHOOL USING FUNCTIONAL AND LINE ITEM CLASSIFICATION

(Dollars)

Function/Object	Estimated Budget 1965-66	 1966-67
Administration		
0112 Sal. Adm.	$ 7,400	$ 8,400
0113 Sal. Busn. Adm.	--	2,800
0130 Expenses	--	--
0151 Legal Services	150	150
0152 Auditing Services	390	450
0159 Contr. Services	2,400	
Instruction		
0211 Sal. Prin.	17,450	13,500
0212 Sal. Consultant or Supv.	--	--
0213 Salary, Teachers	112,950	132,950
02131 Salary, Sub. Teachers	2,600	3,250
0219 Clerical	4,200	4,500
0221 Textbooks	890	1,896
0222 Teaching supplies	18,005	14,955
0223 Library books & supplies	370	717
0224 Audiovisual materials	650	650
0229 Other materials and supplies	715	650
0231 In-Serv training expenses	3,900	3,900
0239 Other expenses	1,625	1,625
Operation of Plant		
0612 Sal. Custodians	3,900	4,200
0621 Matls. & supplies, operations	1,450	1,725
0622 Matls. & supplies, fuel	2,600	2,600
0631 Expenses, utilities	10,075	10,075
0650 Contr. Serv. for operations	390	390
Maintenance of Plant		
0743 Equip. Replacement, Instr.	4,300	3,800
0744 Equip. Replacement, Noninstr.	25	50
0750 Contr. Serv. for Maintenance	13,607	14,484

Table IV-13 (concluded)

Function/Object	Estimated Budget 1965-66	Estimated Budget 1966-67
Fixed Charges		
0831 Retirement Contributions	$ 8,060	$ 10,812
0832 Social Sec. Taxes	1,495	2,597
0833 Workmen's Compen. Ins.	260	365
0834 Employee Ins.		1,000
0835 Fire & other Ins.	1,495	1,800
0838 Rental, facilities & equip.	25,000	25,000
Subtotal	246,352	269,292
Capital Outlay		
1242 Buildings		
1243 Equipment, Instr.	10,620	1,565
1244 Equipment, Noninstr.		
Subtotal	10,620	1,565
Total	$256,972	$270,857

appears in these distributions over time. Walter Garms has attributed this lack of secular variation in the functional distribution of expenditures to rigidity brought about by "widespread use of formulas for the determination of the various items in the budget."[37]

Analytically, the classification of specific expenditures to the various functions in the budget as in Table IV-13 leaves much to be desired. To know that 62.3 percent of current expenditures are for the instruction function is not a particularly useful piece of information. In the illustration, the area vocational-technical school operates no general education programs. Therefore, the entire annual cost is part of the vocational instruction program--physical plant is neither maintained nor operated independently of the instruction program. Under conventional accounting procedures, however, the instruction function is not assigned the full costs of actual instruction, but only the direct cost of teachers and some materials and supplies. Repair of instructional equipment, say a turret lathe, would typically be classified as maintenance of plant. Costs of electricity for the machine shop would be reported under operation of plant. It should be more useful to structure the budget by curriculum areas, then display teacher/student contact hours and all resource costs associated with activities in each curriculum area.

Problems in Budget Evaluation

In evaluating budgeting for vocational-technical education, several questions could be posed, a narrow efficiency criterion could be adopted, and answers could be attempted. But what would this tell us? What are budgeting procedures and documents supposed to accomplish? Are actual budgeting methods effective in terms of intended objectives? Is the attained level of budgeting effectiveness, if known, being achieved at the lowest possible cost? Or, put differently, do given outlays on budgeting yield maximum effectiveness.

The above set of questions, although formally correct, elevate the evaluation problem to unrealistic levels. Such a line of questioning would probably drive school administrators away. They realize the grosser deficiencies in historical budgeting practices and have innovated many improvements in recent years.

There are more serious problems to be resolved before effective budgeting for vocational-technical education will be attained. It is not conceptually clear, for example, what vocational and technical education is. We do not know the precise nature of vocational-technical education, how much of it there is, who produces it, who gets it, and surprisingly, even what it costs. Empirical studies often use the federal classification of whether an activity is vocational or not, using as a criterion, whether the activity qualifies for federal vocational support. This leaves the measured scope of vocational activity to the whims of Congress as it decides to extend or decrease national support. Even lower level problems are evident--detailed knowledge of patterns of existing budgeting practices is not available.

Current and Capital Budgeting. Inspection of the available statistical data, reflection on institutional descriptions, and observations of large city school boards in action suggest two potentially valid generalizations. First, states and local school systems engage in highly detailed planning for current and expected future capital outlays. Capital budgeting,* as practiced, in some sense has reached a rather highly refined level within a few states. Capital planning yields concrete results that administrators and boards of education can readily grasp, unlike the intangibles intrinsic to many of the other pressing contemporary educational issues. Second, interestingly, the capital facilities so carefully planned do not appear to be closely supported by multiple year instructional activity planning.

Other Evaluation Problems. Rigorous evaluation is further retarded by the lack of homogeneity in school system and state budgeting practices. Observation of budgets and the budgeting process in several large cities reveals considerable intercity variation.[37] Garms, et al., found that "in only seven of the fourteen big city school systems studied did principals participate in the budget process, and then not in a role of central importance." Also there are fiscally dependent and fiscally independent school systems; systems with strong or weak leadership; systems where superintendents who, for budgeting purposes, are subordinate to their "coequal" business officers. The result is that educational plans may shape school system budgets, or school system budgets may shape educational plans. And, unfortunately, it seems that school system budgets are too often allowed to shape educational plans. The point is that dominance of one or the other, and not constructive interaction, exists.

Large city systems are emphasized here because within many of the more populous states, two or three of the largest school districts claim to provide the majority of vocational-technical student openings in their respective states. In other states with less concentrated populations, the big systems are relatively less important in providing vocational education. Table IV-14 shows the variation among some of the larger public school systems in percentage of state enrollment in specialized vocational, trade, and technical high schools, as compiled by The Research Council of the Great Cities Program for School Improvement.

Not surprisingly, these data show that large cities have a larger proportion of high school students in vocational trade, and technical schools than their relative shares of total state high school enrollments. Presumably, certain minimum size districts are required for successful operation of specialized high schools. A commonly asserted optimum high school district size for supporting the specialized high schools is often given as 4,500 to 5,000 students. Thus, only the larger districts are likely to create specialized institutions. Baltimore, for example, has all of the

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* Refers to costs of constructing new buildings and renovations as phased over the next five to ten years.

Table IV-14

SCHOOL SYSTEM ENROLLMENTS AS TO PERCENTAGE OF STATES K-12 ENROLLMENT AND VOCATIONAL, TRADE, AND TECHNICAL ENROLLMENT 1962-63

School District	Percent of State K-12 Enrollment	Percent of State Vocational, Trade, and Technical Enrollment
Baltimore	26.9%	100.0%
Boston	10.3	22.2
Buffalo	2.4	10.3
Chicago	26.1	58.9
Cleveland	6.9	61.9
Detroit	16.3	96.4
New York City	34.9	71.6
Philadelphia	12.2	11.5
Pittsburgh	3.5	5.4
St. Louis	12.1	67.6

Source: Board of Directors of the Research Council of the Great Cities Program for School Improvement, The Challenge of Financing Public Schools in Great Cities, 1964, Table 4.

1962-63 vocational, trade, and technical places in Maryland. Buffalo and New York City have 81.9 percent of the specialized places in New York, and Chicago has 58.9 percent of the specialized places in Illinois. Yet, these figures are not very meaningful, since a significant proportion of total student vocational-technical class hours are offered in the comprehensive or regular high schools and not in specialized high schools.

Table IV-15 shows a financial breakdown for Chicago of direct personnel, materials, and supplies inputs for specific vocational activities in both general and trade and vocational high schools. The regular high schools enrolled about 125,000 in September 1965, while about 14,000 students were enrolled in the vocational high schools. Thus, in terms of vocational educational resources, more than twice the volume alloted to the trade and vocational high schools were allocated to the regular high schools, although more than 10 times as many students were enrolled in the latter. Judging by the direct dollar input of resources, the bulk of vocational education offerings was conducted in regular Chicago high schools, even though Chicago has several trade and vocational high schools. As judged by these data, the three largest activities in each type of high school are identical: business education, home economics, and drafting.

Table IV-15

COMPARATIVE PERSONNEL, MATERIALS, AND SUPPLY COSTS BY ACTIVITY AND ORGANIZATIONAL UNIT FOR CHICAGO PUBLIC HIGH SCHOOLS

Activity	Costs at General High Schools	Costs at Trade and Vocational High Schools
Home economics	$1,033,404	$ 234,290
Architectural drafting	58,426	21,524
Automotive	112,641	156,616
Aviation	8,786	49,819
Beauty culture	--	75,672
Bricklaying	--	9,496
Chef training	--	37,332
Commercial art	20,079	12,440
Carpentry	--	56,137
Cabinet making	--	27,074
Drafting	583,959	269,666
Electricity	127,457	175,726
Electronics	15,980	76,898
Foundry	68,159	22,447
Horticulture	--	14,236
Industrial arts	317,084	77,117
Linotype	6,900	20,500
Machine drafting	76,301	13,833
Machine shop	102,615	157,230
Millinery	--	11,642
Painting	--	49,805
Patternmaking	8,450	12,694
Plastics	9,432	34,876
Plumbing	--	60,385
Print shop	290,830	181,291
Sheet metal shop	--	125,372
Shoe repair	--	7,576
Tailoring	--	44,685
Trade dressmaking	--	43,170
Welding	7,950	48,934
Woodshop	414,000	107,909
Business education	3,138,614	634,445
Practical nursing	--	181,526
General shop	45,174	--
Total	$6,446,241	$3,052,363

Source: Board of Education, City of Chicago, Annual Budget 1965 (Chicago: Board of Education Printing Plant, n.d.), pp. 944-49, 958-62.

This section has emphasized problems in the evaluation of educational budgeting and budgets. Following conventional budgeting practices, the discussion focused on school system inputs, the educational expenditures. What is expected to emerge from the school system--the educational product--has been overlooked. This oversight is consistent with the classical public finance assumption that the value of government output is equal to the value of inputs. This standard assumption is open to serious challenge.

Vocational Activity Decision-Making

In the past, vocational education and the vocational curriculum have been partially isolated from other educational decision-making. There has been a discernible tendency in many school systems for vocational education and associated academic curricula to be completely differentiated from the rest of the educational system. Consequently, at the state level, planning to accomplish objectives, as reflected in the state budget, appears to be unrelated to real levels of decision-making. States are most likely to be concerned with a careful sequencing of vocational education courses through time for both in-school youths and adults. Here vocational education is viewed as a continuum to be coordinated from the lower grades through posthigh school institutions. Yet vocational program initiation and operation responsibility is usually vested in local school districts--not in state departments of education. Thus, state "programs" and budgetary decisions actually are often the derivative result of decentralized decision-making by local school districts. Therefore, desired state objectives are seldom realized directly as a result of conscious state policy-making and implementation.

Institutional Arrangements

At the high school level, there seems to be little agreement among educators on the optimum institutional arrangement for providing and producing vocational education. At one extreme, there is considerable agitation for a thorough integration of vocational education activities with other instructional activities in the context of the comprehensive high school. At the other pole, there is pressure for specialized vocational high schools (even through grade 14) that are independent of the general and academic high schools. Somewhere between these two positions are located the proponents of skill centers and area vocational-technical high schools. Thus, the way in which vocational education budgeting is related to elementary, secondary, and higher education budget formation depends largely on local institutional arrangements.

At least two distinct trends for the production of vocational education are emerging in several states. Pennsylvania's Department of Public Instruction, for example, is supporting the development of a statewide network of area vocational-technical schools.

> State and local leaders throughout the Commonwealth [of Pennsylvania] have been meeting this challenge [for more vocational education] through enabling legislation encouraging the organization, establishment and operation of area vocational technical schools on a regional basis.[38]

So far Pennsylvania has approved 73 attendance areas for these schools, and 17 schools are in operation. Pennsylvania is currently engaged in a building program to construct these regional schools. In FY 1965-66, contracts for construction and equipment were awarded for $23.7 million; for FY 1966-67, awards totaled $41.1 million; for FY 1967-68, $5 million; and for some more distant date $7.7 million.[38, p.5] As the Pennsylvania State Director of Vocational Education notes,

> In making vocational training and retraining accessible to everyone, an attempt will be made to be realistic. Each community is charged to plan its education program with the need to adjust to frequent changes taking place in the economy and in the world of work.[39]

The other trend, paralleling developments in Cleveland and Chicago, is occurring in Pittsburgh. Here the emphasis is on providing vocational education in comprehensive high schools. Following this trend, Pittsburgh has developed what it calls the OVT (occupational-vocational-technical) program.

> Flexibility is the by-word! Now it is possible for a student to follow a skill-centers program and at the same time gain academic credits towards college entrance. The flexibility works to the advantage of the student in the event he changes his mind midway in his program . . . .
>
> This is part of the Board's over-all plan to conduct most OVT Training in comprehensive high schools rather than in separate vocational high schools as in the past.[40]

Given the difficulty in empirically determining the optimal institutional arrangements, one can expect continued but unresolved debate over the relative merits of integrated and separated provision of vocational education. For some states, the optimum may well turn out to be the comprehensive approach in metropolitan areas and area vocational-technical schools in nonmetropolitan areas.

Budget Preparation

What group should prepare the vocational education budget? Should this group be the same organization and personnel that prepare other education subbudgets or should it be an independent group? Answers to these questions should be based on normative administrative efficiency considerations. That is, what is the ideal budgeting arrangement from the point of view of administrative and organizational theory? But from a positive position, it is asserted that budgeting be the function of staff that can ask the right questions.*

In some cities, vocational education budgeting is an unplanned process that is the summed result of a number of quasi-independent decisions. A school survey study in Philadelphia in 1965 concluded:

> The field of occupational education as it exists in Philadelphia currently consists of separate programs with little intercommunication among them. Each has its own pattern of operation which . . . makes it less effective than it should be . . . . The programs of the senior high schools are largely individual and not much related to the technical occupational programs.[42]

Essentially, resource allocation problems are different under coordinated decision-making compared with fractionated decision-making. But regardless of the structure of the decision-making process, a good budget requires a good plan, especially if the two are viewed as integrated. Hopefully, sound analysis along with careful planning will lead to more rational decisions. Some changes in current budgeting practices should prove useful to decision-makers.

Conclusion

Many policymakers are discovering that the application of budgeting procedures that integrate intermediate range operations planning with intermediate range financial planning improves the quality of decision-making. Most organizations (government and private) hope to achieve several major objectives. Given these objectives, it is possible to identify groups of institutional activities that lead to the attainment of each objective. Each group of activities that is collectively carried out to achieve a major objective can be defined as a program. Since organizations frequently have multiple objectives, and thus multiple programs, an institutional budget organized in a functional format will often include several programs. Each program in a program budget consists of all organized activities and resources that have outputs clearly related to achieving a common major objective. A distinguishing characteristic of a program budget is the projection of integrated fiscal and operational plans far enough into the future so that decision-makers can appreciate the future implications of current choices.

Program Selection

The program budget displays a structured list of organization objectives or programs. All of the costs associated with each program are identified and assigned. This budget links (1) program planning with fiscal planning and (2) current operations with future plans. The annual budget as derived is a one-year phase of a specified long range organization plan. This budget system also helps in evaluating progress toward attaining stated organization objectives. Long range planning is integrated with the budgetary process in this system.

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* For a dissenting view, see Reference 41, in which the author disregards institutional differences, concluding that vocational education is unique and should be administered as a unit.

Before a blueprint for a program budget can be drawn, however, an initial conceptual problem must be resolved so that major programs can be identified. This problem is the definition of the ultimate objectives of the organization as they are realized through operational decisions.[43] What set of objectives is the institution organized to achieve? In practice, major programs will likely be identified by high level policy decisions. Hirsch defines a program as ". . . a cluster of government activities that are in closer competition with each other than those outside the program and whose output has a clearly identifiable purpose."[44]

Illustrative Program Budget

Table IV-16 presents an illustrative program budget format for an area vocational-technical high school. In this context, the seven major occupational categories are utilized as the principal programs for instruction. By stratifying each program into remedial and regular activities, we can explicitly identify both compensatory activities undertaken for equity purposes and conventional instruction. This particular format permits the analysis of multiobjective schools: preparation of students for the world of work by occupational group, conventional and compensatory instruction, and, indirectly, socialization goals that presumably can be structured into the curriculum.

The performance units listed do not exhaust the range of possibilities. Several potentially useful indices have been listed that are unquestionably of both administrative and analytical interest. Information on average unit costs (if calculable), the dropout rate, number of student credit hours produced, probability of placing students, and expected earnings and earnings variation should prove extremely useful for interoccupational resource allocation decisions.

Three supporting noninstruction programs are listed that are primarily of joint input (or general overhead) nature. Counseling and placement as well as transportation costs in principle could be allocated to the seven instruction programs if sufficiently detailed records were available. Traditionally, however, transportation, at least, has been of intrinsic interest to several levels of policymaking, so its isolation may be of some merit. General administration benefits all programs and, except at the margin, cannot be correctly allocated among programs.

Presenting data for accounting periods and changes between accounting periods facilitates examining changes in average relationships from year to year and incremental costs from year to year as operating levels of programs change.

Table IV-16

ILLUSTRATIVE PROGRAM BUDGET FORMAT FOR AN AREA VOCATIONAL-TECHNICAL SCHOOL

Program/Object	FY 1967	1966-67	FY 1971	1970-71
Agriculture				
Remedial Activities -- Agriculture				
Personnel services				
Supplies				
Capital outlay				
Performance units				
Cost/student hour				
Cost/remedial student transferring to regular activities				
Regular Activities -- Agriculture				
Personnel services				
Supplies				
Capital outlay				
Performance units				
Cost/teacher-student contact hour				
Dropout rate				
Number of student credit hours				
Estimated probability of placing these students in this occupation				
Average expected lifetime earnings in this occupation				
Standard deviation, expected lifetime earnings in this occupation				
Distribution education				
Health occupations				
Home economics				
Office education				
Technical education				
Trade and industry				

Table IV-16 (concluded)

Program/Object	FY 1967	1966-67	FY 1971	1970-71
Supporting programs				
Counseling & placement				
Counseling cost/student hrs. contact				
Placement cost/no. students placed				
Transportation				
Cost/100 student miles				
Average daily distance students are transported				
General administration				
Total cost vocational instruction				

It may even be useful to work initially with two or more alternative sets of programs. Then, after some experience with program budgeting, decision-makers can adopt the particular set of programs that appear to be the most useful. Hopefully, the major operational impact of program budgeting is a more rational assessment of ends and means, of inputs and outputs, of goals and resources--at all levels of decision-making authority.

Discussion

Mr. Kotz:

Thomas Fox's paper was designed primarily to discuss budgeting for vocational-technical education and its relation to other aspects of the planning, programming, and decision-making process. I think we might, at the outset, address ourselves to his criticism that programs, facilities, and budgets are evolved without regard to the objectives and goals.

Mr. Bowen:

Is it not the state's prerogative to make the decisions about substance? One thing that has bothered me is that we keep mixing process and substance. The states control education. As I understood the purpose of this conference, it was to give the states advice on more adequate balancing and assessment of their goals and their means for deciding whether they really are budgeting for what they want. There also seems to be mixed in this conference too large a dose, to my mind, of what the schools should have. It is true that in this area the federal government has more control than in most areas, but still the responsibility is delegated to the states. If in one state, one type of school is appropriate and in another, a variety, you should separate considerations of substance from considerations of process. How can the decision-making process be exercised at the national, state, or local level?

Dr. Thomas:

I do not want to let Mr. Bowen's sharp separation between process and substance go unchallenged. The main thing I have achieved in this conference is the contribution of benefit/cost studies to deciding what one really wants. The significance of Mr. Kotz's paper to me was that it would contribute to a kind of program budgeting that would be based on systematic planning and would facilitate benefit/cost studies. Facilities would be related to curriculum and program goals, and benefits and costs of their approaches would be measured and evaluated. The process and the substance are related.

Dr. Spiegelman:

The entire matter of program budgeting is really a combination of two elements: (1) a program essentially setting out what you plan to do and (2) a benefit/cost, effectiveness/cost analysis to help you determine what you should do. Essentially, the two things cannot be pulled apart, but you can speak of them separately. I think, if any purpose is served here, it is to show the unification of these two things and not the pulling apart. I do not think anyone here has set forth the set of goals that should be followed by any state, or attempted to make decisions for any state. It is clearly desirable to set goals and then to interrelate the process to them. We are beginning to perceive here that there is no particular understanding of the relationship between the goals and the process, and that is what, if we make any contribution, will come out of this conference.

Mr. Kotz:

I would agree with that, but it is only a portion of what we are to consider. I would also like to point out that in inviting Dr. Mangum to speak here, it was substantially in recognition of his excellent experience and expertise in the area, plus the fact that he is on the President's Advisory Council on Vocational Education. The Council's mandate as to what he looks at comes from the President. He is obligated, with other members of the Council, to make a report that will eventually go to the Congress in January 1968. He gave to this group a preview of the kinds of things that he may recommend be included in that report. I think that kind of preview is very valuable because it reveals to the vocational educators the thinking of at least one important member of the Council. We are taking a look now because new monies have been put into vocational education, and it is pushing us in new directions. If the vocational educators at the state and local levels are sticking to their past programs and not moving in the new directions mandated by the legislation, it behooves the President's Advisory Council to call the shots as it sees them. It is, therefore, an important kind of a message that Garth Mangum brought to us at an early stage of the evaluation process. Since it is early in the Council's deliberative process, there is time to change or influence its report if facts and data can be brought forth to support such change.

Mr. Bushnell:

What I perceive here is the problem of applying a rational framework to a somewhat irrational process. Hopefully, systematic identification of goals, planning, and related allocation of resources at state and local levels will, in fact, help us to begin to achieve some of the goals that we have discussed here. You do not do this by getting involved in the political processes, in the local issues of what kinds of monies are available. You do it by setting these goals very clearly, and hopefully you administer the programs in whatever way you can to influence attainment of these goals in an efficient fashion from the national level.

Mr. Kotz:

Dr. Fox set forth for us illustratively the way a budget is now prepared, which was very helpful. It showed the concentration on inputs such as object classes and organizations, rather than on outputs or missions or end purposes.

Dr. Fox:

There are some states that do a very good job of budget preparation relative to others. Our local school systems have rather elaborate program budget formats that are in a constant state of development. Chicago, for example, has a reasonably good program budget that is being developed further. Memphis has one, and Philadelphia is working on one. However, in general, budget preparation is not being done well either in the local school systems or in the states.

Mr. Kotz:

Montgomery County, Maryland, has a very good budget but you cannot trace out some of the things that we are talking about here. It has a capital budget, separate from an operating budget, but it does not have a program budget.

Mr. Durnell:

There is no doubt about the need for a program budget. I think we would all agree on that. Did you find in your studies and your discussions with these people how measures could be used by school systems in implementation of the program budget?

Dr. Fox:

I have several different formats in mind that seem to be reasonable. To me, it is not at all clear that there is one, uniquely applicable format. There are probably several different ways of structuring it depending on whether you are talking about a state or local school system. You may want to carry along alternative ways of classifying it for a while until you decide which is more feasible. For example, you might talk about the average cost of a student placed.

Dr. Worthington:

The paper raised the question as to who should prepare the vocational budget and whether someone outside of vocational education might best do it. This seemed to me to be inconsistent with Dr. Fox's statement that curriculum should be developed by the educators occupying the facility. I wonder if Dr. Fox would elaborate on that?

Dr. Fox:

Certainly. In a public school system, under a system where the superintendent has a responsibility for determining what goes on within the system, he clearly should have the final say on the budget. It should not be handed to him by vocational education people any more than the English program ought to be determined by the English people or the math program by the math people. The overall structure of an educational program for a whole school system should not be determined by people interested only in vocational education or by people interested only in the academic aspects. Someone has to come up with a notion of what a desirable mix should be. Such a decision is implied when 50 percent of the resources go to vocational and technical education and 50 percent go to academic education.

Mr. Kotz:

We know we have three states that have separate boards of vocational education, and they are going to prepare the budget for vocational education. They are going to submit the budget with their recommendations to the next higher level of authority and then to the legislature. In other states, the vocational budget will go through the superintendent of education. I do not think the federal level can particularly determine that; it will be determined at the state or local level.

Superintendent Donovan and the Board of Education in New York City have many of the problems that we have discussed here. New York City in 1966 had more than one million pupils, more than 55,000 teachers, and a total budget of well over a billion dollars. Twenty-nine percent of the pupils are Negro, and

21 percent are Puerto Rican, so that many problems of integration and education of the underprivileged segments of society exist. Only 41,463, or 4 percent of the pupils, attend the separate vocational high schools. The per pupil cost of instruction is estimated to be: $807 for elementary schools, $930 for junior high; $1,074 for academic high schools, and $1,470 for vocational high schools.[45] The problem of managing such vast resources is further complicated by additional social problems and political and other pressures all focusing on the school system.

A community action group in New York City insisted that it should have more authority over what the Board of Education does with respect to selecting principals and faculty. The unions composed of teachers said that this was not a layman's prerogative and should be decided only by professionals. Segregation, poverty, and whether vocational education is a "dumping ground" represent additional problems, as do other social issues and the multiple objectives of education. A billion dollar-plus budget and the existence of these problems, led New York City to set up a PPB system for education to enable it to allocate resources better. Out of such efforts, new program structures will emerge related to carefully defined objectives and goals. Planning, programming, and budgeting will be performed on a multiple year basis for both capital and operating inputs and related to the defined goals. Vocational and technical education is considered in the research effort as a portion of secondary education.

Dr. Stromsdorfer:

It is impossible, at the state level, to determine what the average cost is of training a person in one of the broad seven occupational categories. There are varied and competing accounting systems among the communities. Various sections of the costs are scattered around types of administrative forms and documents, and there is duplication in the system, which could result in a double count. There are other types of cost elements that are ignored because there is no administrative requirement to record these things, and when one goes from the fragmentary details that are recorded in an unsystematic manner to the total highly aggregated budget, one cannot get information from there. At the local level, at least in Pennsylvania, out of the 90 or so school districts that have vocational education directors, 14 districts said they had costs by skill. I checked about ten of these but would not vouch for the accuracy of the numbers we finally generated.

Mr. Kotz:

I would say that it would be most difficult to reconstruct sufficient data rapidly that would prove useful in terms of students graduated, students placed in jobs, and the costs of their training, if a system has not been designed to collect it on a regular and consistent basis. We did not find this kind of data available in our surveys and that has come out very clearly in this conference.

Chapter 14

THE VOCATIONAL EDUCATION ACT OF 1963: INTERGOVERNMENTAL FISCAL RELATIONS

by

Bruce F. Davie

Background

The Smith-Hughes and George-Barden Acts, which structured U.S. vocational education for nearly fifty years, authorized specific amounts of federal aid for particular occupational areas. By the beginning of the 1960s, the rigidity of the federal government's program had come to be sharply contrasted with the implications of a rapidly changing economy. In recognition of this, President Kennedy, in his first message to Congress on the problems of U.S. education, requested that the Secretary of Health, Education, and Welfare appoint a panel of consultants to look into alternative approaches to the fulfillment of vocational education needs. In late 1962, the panel of consultants submitted its report.[13] The panel recommended that federal funds be appropriated for training groups of people needing vocational education rather than for specific occupational categories. This recommendation was subsequently accepted by Congress in 1963.[48]

The Vocational Education Act of 1963 designated six purposes for which federal funds could be used, on a matching basis, by states. These matching purposes were: vocational education at the (1) secondary and (2) postsecondary levels, vocational education (3) for adults and (4) for persons with special needs, (5) construction of area vocational schools, and (6) ancillary services. In addition, funds for research were authorized. (Provision was also made in the act for federal support of work-study programs and residential vocational school construction. These two sections of the act have not been analyzed in this report.) The concept of matching purposes is in contrast to the concept of program area as used in the Smith-Hughes and George-Barden Acts. For example, training for office occupations at the secondary, postsecondary, or adult levels can be supported with 1963 Act funds, whereas such training was never included among the program areas eligible for Smith-Hughes or George-Barden support.

Funds appropriated for the purposes outlined in the 1963 Act are allotted among the states on the basis of annual population and income estimates. Neither annual population data nor the income variable are used to allot Smith-Hughes and George-Barden funds. These two acts were not repealed by the 1963 legislation, but some fiscal flexibility was introduced by a provision permitting states, with the approval of the U.S. Office of Education, to transfer allotments received under any of the three acts to any of the other acts.

Although the Vocational Education Act authorized $60 million for fiscal 1964, no funds were appropriated. The full authorizations of $118.5 million for 1965 and $177.5 million for 1966 were appropriated. For fiscal 1967, the authorization of 10 percent of the total appropriation for research was not fully funded as Congress appropriated $10 million for research and $198.2 million for allotment to the states; the total amount was less than the $225 million authorized for fiscal 1967. For every year after 1967 the total authorization remains at $255 million.

Intergovernmental Fiscal Relations

Figure IV-6 graphically summarizes the intergovernmental fiscal relations associated with appropriations authorized by Section 2 of the Vocational Education Act of 1963. Data for fiscal 1965 have been used for illustrative purposes since this was the first year of funding and the only year for which data are available. The upper portion of the figure is divided horizontally into legislative and budgetary processes and allotment and expenditure processes. The lower portion shows the final uses of federal, state, and local funds associated with the 1963 Act. Vertically, the figure is divided into federal, state, and local sections. The processes represented in the uppermost portion of the figure have been simplified, particularly at the state and local levels.

At the federal level, there are three participants--Congress, the BOB (Bureau of the Budget), and the HEW-OE (Department of Health, Education, and Welfare-Office of Education). There are two types of Congressional legislation represented: authorizations included in the 1963 Act (denoted by heavy lines) and annual (denoted by light lines) appropriation acts, which provide federal funds up to the limits set in the authorizing legislation. The influence of BOB and HEW-OE on the permanent legislation is indicated by open arrows. The influence of their annual budget recommendations is shown by heavy arrows. HEW-OE may influence annual appropriations either working through BOB or directly.

In accordance with the state plan, final federal allotments are used to reimburse state or local expenditures for vocational education. The state plan influences, and is influenced by, state legislation. Such legislation may authorize appropriations of state funds for vocational education as well as structuring the state's program in terms of the relative roles of the state compared with that of localities. These laws may specify formulas for allotting state aid among localities. Similarly, allotment criteria may be included in the state plan to distribute all or some portion of final federal allotments to localities for reimbursing their expenditures. In addition, localities may appropriate funds of their own to be spent on vocational education.

The Vocational Education Act of 1963 (Section 4): Intergovernmental Fiscal Relations, 1965

This figure depicts for 1965 the major elements of the intergovernmental fiscal relations associated with the 1963 Vocational Education Act (Section 4). The top band illustrates the legislative and budgetary processes at the federal, state, and local levels which determine the amount of public funds that are made available for vocational education. The processes and interactions shown are only the most significant ones; the figure of necessity has been simplified and excludes some influences at all three levels of government. The middle band shows the flow of funds through the mechanisms of intergovernmental fiscal relations which ultimately results in the expenditures listed in the lower band. The 1963 Act requires that for each expenditure purpose in each state, state and/or local funds match the expenditure of Section 4 federal funds at least dollar for dollar.

This figure excludes the Work-Study Program (Section 13 of the 1963 Act) and the Residential Vocational Education Schools Program (Section 14). For fiscal 1965 $30,000,000 was authorized by the Act for both Sections 13 and 14; $5,000,000 was appropriated for the Work-Study Program and $2,799,794 was expended.

FIGURE SYMBOLS:

Flows of Influence	
Occurring only once	⇒
Annual or continuing	➡
Flows of Money	→
Elements of Influence or Action	
Occurring only once	⧈
Permanent	▣
Annual or continuing	▭

FOOTNOTES:

*Any Federal funds not used in the fiscal year for which they are appropriated must be returned to the U.S. Treasury. Aside from the three sources shown, funds may be returned to the U.S. Treasury if an audit at the state or local level discloses that federal funds were not spent in accordance with the rules and regulations of the Act.

†Unpublished figure supplied by Dr. David S. Bushnell, Director, Division of Adult and Vocational Research, Bureau of Research, U.S. Office of Education..

SOURCE: Preliminary data supplied by the Division of Vocational and Technical Education, Bureau of Adult and Vocational Education, U.S. Office of Education.

FIGURE IV-6

THE VOCATIONAL EDUCATION ACT OF 1963 (SECTION 4): INTERGOVERNM
FISCAL RELATIONS, 1965

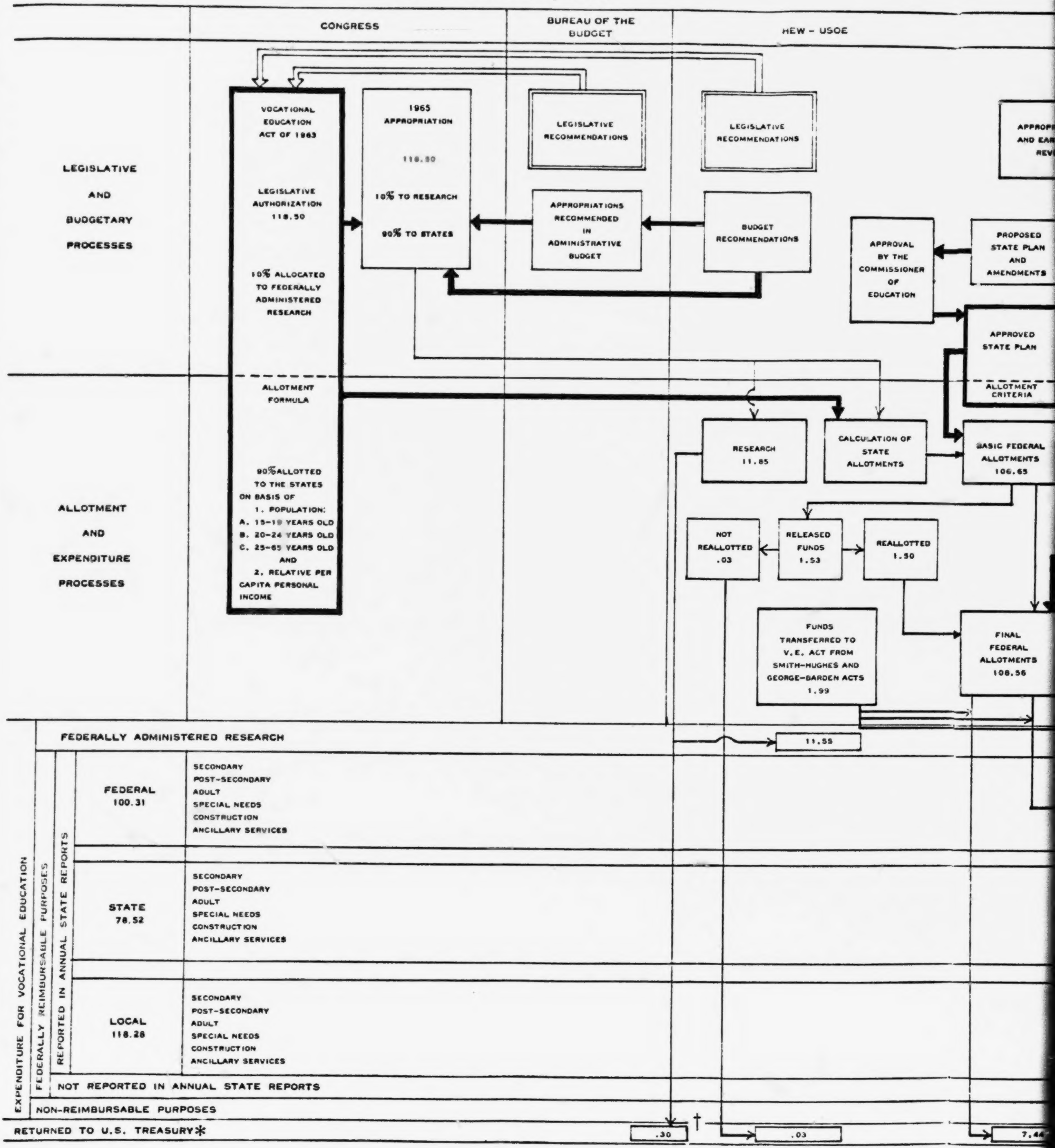
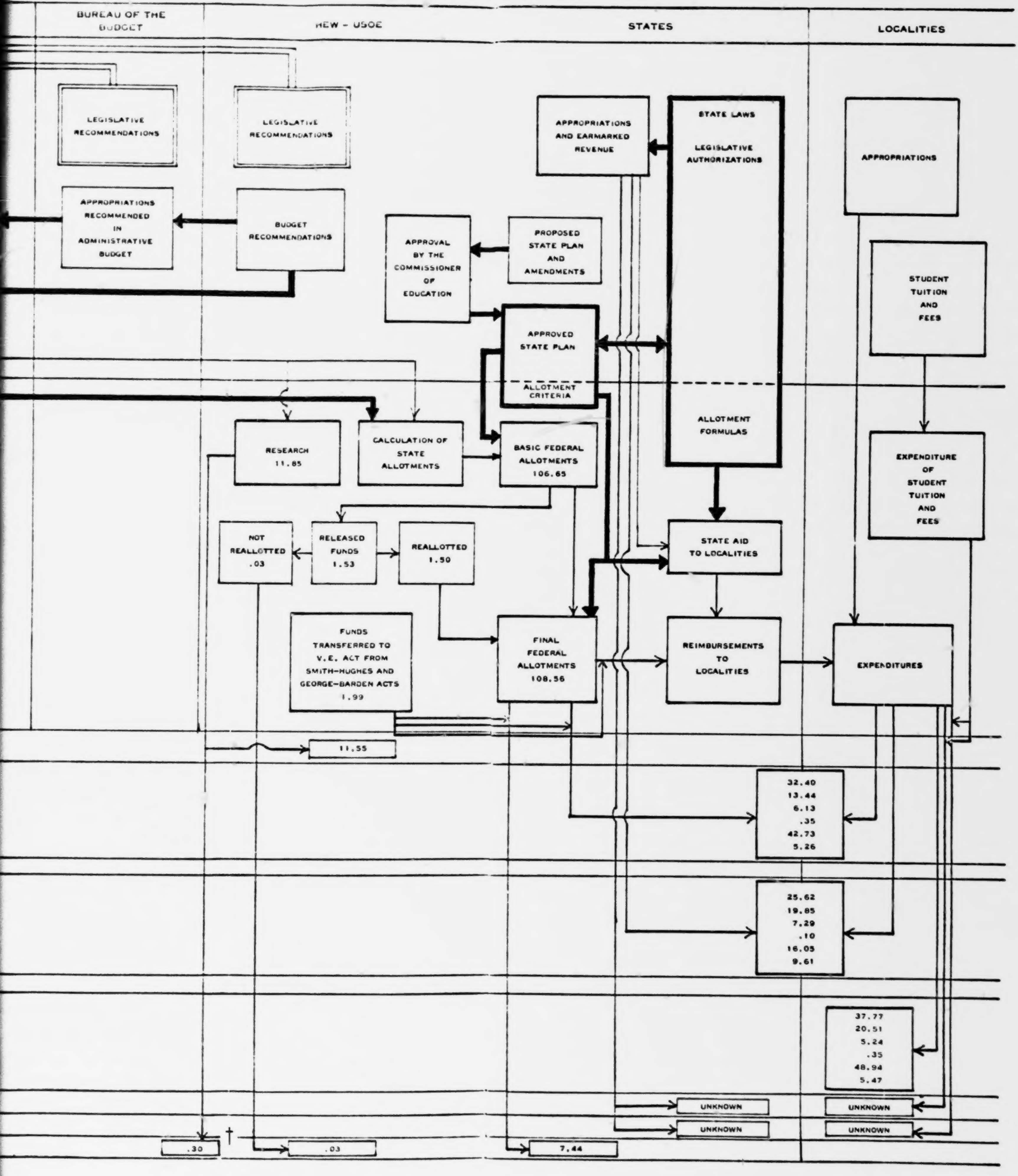

CONGRESS
BUREAU OF THE BUDGET
HEW - USOE
LEGISLATIVE AND BUDGETARY PROCESSES
VOCATIONAL EDUCATION ACT OF 1963
LEGISLATIVE AUTHORIZATION 118.50
10% ALLOCATED TO FEDERALLY ADMINISTERED RESEARCH
1965 APPROPRIATION
118.50
10% TO RESEARCH
90% TO STATES
LEGISLATIVE RECOMMENDATIONS
LEGISLATIVE RECOMMENDATIONS
APPROPRIATIONS RECOMMENDED IN ADMINISTRATIVE BUDGET
BUDGET RECOMMENDATIONS
APPROVAL BY THE COMMISSIONER OF EDUCATION
PROPOSED STATE PLAN AND AMENDMENTS
APPROVED STATE PLAN
ALLOTMENT CRITERIA
APPROP
AND EAR
REV
ALLOTMENT AND EXPENDITURE PROCESSES
ALLOTMENT FORMULA
90% ALLOTTED TO THE STATES ON BASIS OF
1. POPULATION:
A. 15-19 YEARS OLD
B. 20-24 YEARS OLD
C. 25-65 YEARS OLD
AND
2. RELATIVE PER CAPITA PERSONAL INCOME
RESEARCH 11.85
CALCULATION OF STATE ALLOTMENTS
BASIC FEDERAL ALLOTMENTS 106.65
NOT REALLOTTED .03
RELEASED FUNDS 1.53
REALLOTTED 1.50
FUNDS TRANSFERRED TO V.E. ACT FROM SMITH-HUGHES AND GEORGE-BARDEN ACTS 1.99
FINAL FEDERAL ALLOTMENTS 108.56
FEDERALLY ADMINISTERED RESEARCH
11.55
EXPENDITURE FOR VOCATIONAL EDUCATION
FEDERALLY REIMBURSABLE PURPOSES
REPORTED IN ANNUAL STATE REPORTS
FEDERAL 100.31
SECONDARY
POST-SECONDARY
ADULT
SPECIAL NEEDS
CONSTRUCTION
ANCILLARY SERVICES
STATE 78.52
SECONDARY
POST-SECONDARY
ADULT
SPECIAL NEEDS
CONSTRUCTION
ANCILLARY SERVICES
LOCAL 118.28
SECONDARY
POST-SECONDARY
ADULT
SPECIAL NEEDS
CONSTRUCTION
ANCILLARY SERVICES
NOT REPORTED IN ANNUAL STATE REPORTS
NON-REIMBURSABLE PURPOSES
RETURNED TO U.S. TREASURY*
.30
†
.03
7.44

FIGURE IV-6

TIONAL EDUCATION ACT OF 1963 (SECTION 4): INTERGOVERNMENTAL
LATIONS, 1965


BUREAU OF THE BUDGET
HEW - USOE
STATES
LOCALITIES
LEGISLATIVE RECOMMENDATIONS
LEGISLATIVE RECOMMENDATIONS
APPROPRIATIONS AND EARMARKED REVENUE
STATE LAWS
LEGISLATIVE AUTHORIZATIONS
APPROPRIATIONS
APPROPRIATIONS RECOMMENDED IN ADMINISTRATIVE BUDGET
BUDGET RECOMMENDATIONS
APPROVAL BY THE COMMISSIONER OF EDUCATION
PROPOSED STATE PLAN AND AMENDMENTS
STUDENT TUITION AND FEES
APPROVED STATE PLAN
ALLOTMENT CRITERIA
ALLOTMENT FORMULAS
RESEARCH 11.85
CALCULATION OF STATE ALLOTMENTS
BASIC FEDERAL ALLOTMENTS 106.65
EXPENDITURE OF STUDENT TUITION AND FEES
NOT REALLOTTED .03
RELEASED FUNDS 1.53
REALLOTTED 1.50
STATE AID TO LOCALITIES
FUNDS TRANSFERRED TO V.E. ACT FROM SMITH-HUGHES AND GEORGE-BARDEN ACTS 1.99
FINAL FEDERAL ALLOTMENTS 108.56
REIMBURSEMENTS TO LOCALITIES
EXPENDITURES
11.55
32.40
13.44
6.13
.35
42.73
5.26
25.62
19.85
7.29
.10
16.05
9.61
37.77
20.51
5.24
.35
48.94
5.47
UNKNOWN
UNKNOWN
UNKNOWN
UNKNOWN
.30
†
.03
7.44

In the lower portion of Figure IV-6, reported expenditures for federally reimbursable programs of vocational education are classified as to source of funds--federal, state, or local. Within these classifications, expenditures are identified by purpose. Federal funds are in part expended directly by the states and the remainder is either distributed to and expended by localities or reverts to the Treasury. Reporting procedures do not distinguish between state and local expenditure of federal funds, thus, the box in which these expenditures are listed straddles the line between states and localities. Similarly, state funds may be expended for federally reimbursable programs either directly by the state or through localities and likewise are not reported separately. The source of reported local expenditures for reimbursable programs is clearly the localities themselves. The 1963 Act requires that combined state and local expenditures for reimbursable purposes at least match the federal funds expended, purpose by purpose and state by state.

Not all state and local expenditures on federally reimbursable purposes are reported. Some local vocational education expenditures are paid for by student tuition and fees, but these cannot, under the terms of OE regulations, be used to match federal funds and are therefore not reported. Local expenditures out of regular revenue sources, including state aid, may also be made for federally reimbursable purposes but go unreported. Some expenditures of state funds made at the state level may also be excluded in reports made to OE. States may leave unreported some expenditures, either at the state or local level, so that additional federal funds may be easily matched at some future date or to increase program flexibility. Given that there is no fiscal reward for substantial overmatching, states and localities are perhaps reluctant to devote the effort necessary to report total expenditures on federally reimbursable purposes, especially when costs are spread over several purposes, some of which may not qualify for federal support.

Figure IV-6 has shown the flow of federal appropriations through a complex network of intergovernmental fiscal relations. Such an exercise puts the known information concerning the fiscal aspects of vocational education in a framework that illustrates some limitations of these data. The magnitude of student tuition and fees is unknown, the extent to which reported expenditures approximate total expenditures is not known, and no attempt is made to report on nonreimbursable purposes. The full use of federal funds for the purposes intended by Congress would require that no part of the appropriations be returned to the U.S. Treasury. OE makes no attempt in its published data to identify these reversions to the Treasury either by program area or by state. Such an identification would aid in evaluating the total federal program.

In Fy 1965, expenditures for vocational education were also made under the terms of the Smith-Hughes and George-Barden Acts, $53.8 million of federal funds, $108.2 million of state funds, and $142.6 million of local funds. The permanent authorization and the annual appropriation of Section 2 funds under the 1963 Act differ from that for the Smith-Hughes and George-Barden Acts in that federal funds are not tied to program areas. Expenditures associated with the 1963 Act are classified by broad educational purposes. Ten percent of the authorization and appropriation is set aside for federally administered research (such as this study). The remainder of the federal funds is allotted to the states on the basis of state shares of the population in three age groups and state per capita personal income.

For a state to use any of its basic federal allotment of 1963 Act funds, it had to submit a new state plan and have it approved by OE. For this reason, 50 states had new state plans approved in 1965. The 1963 Act contains a reallotment provision, and as a result of this, the reallotment of released funds redistributes some of the basic allotment among states so that basic and final allotments differ. A provision of the 1963 Act allows states, on approval by OE, to transfer funds allotted to a state under one vocational education act to another act. A box appears in Figure 1 in the OE column that shows the transfer from the Smith-Hughes and George-Barden Acts to the 1963 Act. (No 1963 Act funds were transferred to the Smith-Hughes or George-Barden Acts.) As a result of this transfer provision, total federal funds available to states were greater than the appropriation for the 1963 Act.

Allotment Provisions

The Vocational Education Act of 1963, like many other federal grant-in-aid programs, contains an allotment provision by which the fixed annual appropriation is divided among the states. There are two basic components of the allotment process, a measure of the need for the program in each state and an adjustment in state allotments in accordance with relative state fiscal capacities, although not all grant-in-aid programs contain such equalization provisions. Section 3 of the 1963 Act calls for population in various age groups to be used as a measure of program need, weighted by allotment ratios, which, as a measure of fiscal capacity, express per capita personal income in a state relative to per capita personal income in the nation. (Allotment ratios will be explained more fully below.) Fifty percent of the total appropriation for Section 2 of the Act is distributed on the basis of 15-19 year olds, 20 percent on the basis of 20-24 year olds, 15 percent on the basis of 25-65 year olds and 5 percent on the basis of 16-65 year olds, similarly weighted. The remaining 10 percent is reserved to be used for research by the U.S. Office of Education.

Inherent in the process by which federal appropriations are allotted under the 1963 Act is the dependence of the allotment received by any one state on the population and income variables in not only that state but also in every other state as well. If the federal appropriation is thought of as a pie to be divided among the states, the share of the pie received by any one state is affected by changes in population and income in every other state.

Part of the rationale of the Vocational Education Act of 1963 was to make vocational education accessible to all persons. As an Office of Education pamphlet puts it,

> The act is comprehensive: it shuts out no group, no occupation, except those generally considered professional or as requiring a baccalaureate or higher degree. It is concerned about workers of all ages at all levels for all fields; about persons in sparsely settled areas as well as the urban; about delinquent young people as well as the most industrious; about the employed as well as the unemployed and the underemployed.[47]

This broad concern is reflected in the allotment provisions of the Act by the use of population in three age groups--15-19 years, 20-24 years, and 25-65 years--as the basic measure of the need for federal funds. By assigning heavier weights to the two younger age groups than for the 25-65 age group, the Act implicitly recognizes that it is relatively more important or necessary to provide this type of educational opportunity for younger people.

The use of these three age groups, and their respective weights, yields state shares that are significantly different from state shares using total population. States with relatively larger percents of their total population in the heavily weighted 15-19 age group receive larger shares of the federal appropriation. Most of the southern states have their shares increased when the weighted age groups are used, reflecting the fact that past migration has reduced the relative number of persons over the age of 20. As an example, for every $100 in federal appropriations, South Carolina receives $1.16 if total population are used as the criterion for distribution and $1.37 when weighted age groups are used. Given the size of the federal appropriation in 1966, South Carolina received $315,000 more than it would have received if only total population were used.

When allotment ratios (as constrained in the 1963 Act) are used as an additional factor in allotting the federal appropriation among the states, another set of state shares is obtained. The general result is that whatever change occurred as a result of using weighted age groups rather than total population is reinforced by introducing the allotment ratios. That is, a state with a relatively larger percent of its population in the 15-19 age group is likely to have a relatively lower per capita personal income. This is reasonable because the young people are either not earning income or are not earning incomes as high as older persons. For the ten most populous states, only Florida has a low per capita personal income despite having a relatively high percent of its population outside the 15-19 age bracket. Another notable feature of the ten most populous states is that, with the exception of Texas, their shares are decreased when weighted age groups are used and their shares are decreased even further when per capita personal income is used in conjunction with the weighted age groups. Continuing the same example, for every $100 in federal appropriations, South Carolina receives $1.64 when allotment ratios are used instead of $1.37 if only the weighted age groups are used. In 1966, South Carolina received $405,000 more than it would have received if only the three weighted age groups were used.

Although there is no requirement in the act that funds allocated on the basis of specific age groups be spent on programs designed for those age groups, the basic question may still be asked: Can some method of measuring a state's need for vocational education be based on a priori rationality? The economist's theoretical answer to this question would be that expenditures on vocational education ought to be allocated among the states so that the marginal rates of return on those expenditures would be equated (provided that the marginal rate of return was at least as great as on alternative investments). Such a concept is very difficult to specify fully in the context of a public program like vocational education as evidenced in some of the other papers presented at this conference. In addition, there is no provision in the administration of the vocational education program to generate the type of data needed to calculate marginal rates of return nor would such an approach take into consideration the concept of equality of educational opportunity.

If allocation of funds on the basis of rates of return is impossible, it may still be feasible to develop a better measure of state-by-state program need based on population data. Clearly not everyone between the ages of 15 and 65 is a potential vocational education student. During any given year, some individuals in this broad age span are enrolled in educational programs leading to a baccalaureate or higher academic degrees, others are in the military services, and still others are in nonpublic secondary schools. With perhaps a very small number of exceptions, such individuals cannot be considered potential vocational education students. This would be an unimportant point to raise if such individuals represented the same fraction of the population in every state. This is not the case, however. The number of potential students was calculated from the 1960 Census data by subtracting in each age group the number enrolled in nonpublic secondary schools, in the military service, and in college. Since the Census data make no distinction between junior college and four year college enrollees, it was necessary to add back in junior college enrollment provided by the American Association of Junior Colleges. This was done on the grounds that students in institutions offering postsecondary education that does not lead to the baccalaureate degree are actual or potential vocational education students. These enrollment figures were not divided by age, but it was assumed that half the junior college enrollment fell in the 15-19 age group and half in the 20-24 group. A computer program was used to determine what state shares of the federal appropriation would have been in 1960 had the Vocational Education Act of 1963 been in effect. Then state shares were calculated on the basis of the measure of potential students in 1960 for each of the three age groups. States with large military establishments, like Alaska, Hawaii, and Guam, would experience a large reduction in their shares of the federal appropriation. States like Massachusetts and Rhode Island with large enrollments in colleges and nonpublic secondary schools would experience smaller shares of the federal appropriations. No state would receive an allotment more than 10 percent larger. In summary--the allotment process could be improved by changing the definition of the three age groups to reflect more nearly the potential number of vocational education students in each state. The Bureau of the Census could supply annual estimates of potential students. The analysis, based on 1960 data, indicated that such a change would make a major difference in allotments in only a few states. Since, however, Congress clearly intended state allotments to reflect relative need for vocational education, the measure of potential students suggested here would better match that intent.

A different approach to the question of a priori rationality in that part of the allotment process concerned with measuring program need could be based on developing appropriate weights for various age groups in a state's total population. Assume that the benefits from vocational education are not a function of age; per se, e.g. the annual benefits for the first year after completion of a unit of vocational education are the same for a 20 year-old as for a 45 year-old and that the benefits in subsequent years are the same in both cases. If this assumption is made, weights for each age group could be based on estimated mortality rates and labor force participation rates.

The Vocational Education Act of 1963 includes within its allotment formula an adjustment for the relative fiscal capacity of states or equalization. This aspect of intergovernmental fiscal relations is common to many other federal grant-in-aid programs.[48]

Whatever measure of relative state program need may be used, there are three basic mathematical functions, each with specific parameter values, that have been applied in grant-in-aid programs. Per capita personal income has been used as the measure of state fiscal capacity, although other measures have been suggested. The three mathematical forms are:

1. A linear expression $A_1 = (1 - .5R)$
2. A rectangular hyperbola $A_2 = \frac{1}{R}$
3. A parabola $A_3 = (1 - .5R)^2$

where R is the ratio of a state's per capita personal income to the nation's personal income and where A_1, A_2, and A_3 are the resulting allotment ratios that determine state shares per unit of program need (e.g., per person) of the federal appropriation. In forms 1 and 3, the value of $(1 - .5R)$ is often arbitrarily constrained to something less than the range between zero and one. The relationship between a state's allotment ratio (A_1) and that state's share (S_i) of the federal appropriation, if population in the State (P_i) is used as a measure of program need, is illustrated in the following equation:

$$S = \frac{A_i\ P_i}{\sum_{i=1}^{n} (A_i\ P_i)}$$

Equalization is introduced into a grant-in-aid program by the use of one of the above mathematical functions since all three inversely relate allotment ratios to relative state per capita personal income. The degree of equalization may be defined as the rate at which A decreases as R increases or the first derivative of the function. There are two ways to examine the implications of these functions: one is with a distribution of Rs fixed at a point in time and the other is with a changing distribution of Rs over time. The first is illustrated below with 1965 data, where the values of A_1, A_2, and A_3 are presented for Mississippi, with the lowest R; for the District of Columbia, with the highest R, and for a state whose per capita personal income equals the national income (R = 1.000).

	Mississippi (R = .590)	State whose PCPI equals National PCPI (R = 1.000)	District of Columbia (R = 1.350)
$A_1 = (1 - .5R) =$	.705	.500	.325
$A_2 = \frac{1}{R} =$	1.690	1.000	.741
$A_3 = (1 - .5R)^2 =$	.497	.250	.106

Equalization can be illustrated by comparing the A values for Mississippi and the District of Columbia. In the case of the linear function, for every $1.00 per unit of program need received by the District of Columbia, Mississippi receives $2.16, i.e., A_1 for Mississippi is 216 percent of A_1 for the District of Columbia. The hyperbolic function equalizes to a slightly greater degree, Mississippi receives $2.28 per unit of program need for each $1.00 received by the District of Columbia. The parabolic function results in a marked increase in the degree of equalization: A_3 for Mississippi is 468 percent of A_3 for the District of Columbia.

Tracing the impact on the allotment received by a state where per capita personal income is changing relative to that of the nation is the second way of examining the implications of the functions. The rate at which A changes as R changes becomes relevant: one has to consider the first derivatives of the functions. The first derivative of the linear function is a constant; thus, if the value of R for any state increases by .01, A_1 for that state decreases by .005, regardless of the initial value of R. In the case of the parabola, the slope of the function changes at a constant rate: if R increases, the decrease in A_3 experienced by poor states ($R<1$) will be relatively greater than for rich states ($R>1$). With the hyperbolic function, the rate at which A_2 decreases as R increases approaches 0 asymptotically. As in the case of the parabolic function, when R increases, the decrease in A_2 is relatively greater for poor states than for rich states. Thus with the hyperbolic function, as a rich state gets a little richer it loses very little federal aid; as a poor state gets a little richer it loses a great deal of federal aid.

The degree of equalization that is implicit in the choice of a particular function could only be defended on the grounds of allocative efficiency if the relationship between R and social rates of return to grant-in-aid programs were known. In the absence of such knowledge, the choice of function forms must remain essentially political.

The actual amount of equalization, i.e., the portion of the aggregate federal appropriation that is reallotted from rich states to poor states, depends on the degree of equalization and the distribution of R values, given the distribution of the measure of program need. The effect of a change in mathematical function cannot be demonstrated for any one state without considering the effects on all other states. The allotment formula contained in Section 3 of the Vocational Education Act of 1963 was used to make such a demonstration. The amount of equalization was measured by comparing actual state shares for 1966 with state shares as they would have been without the equalization provision. The portion of the appropriation reallotted was 6.23 percent, i.e., the sum of the increases in shares received by poor states. Had the constraints not been imposed on the allotment ratios, as determined by the linear function, 7.13 percent of the appropriation would have been reallotted. The hyperbolic function would have resulted in an amount of equalization equal to 8.98 percent and the parabola, 14.47 percent.

The shares of all states are affected by releasing the constraints on the allotment ratios. The states most affected are those whose allotment ratios were formerly constrained. Mississippi, for example, receives a 19 percent gain while the District of Columbia experiences a 20 percent loss. Those states whose allotment ratio is between .4 and .6 also are affected due to the interdependence of state shares in such an allotment formula. The result of this interdependence is that all states with allotment ratios of less than .6 lose when federal funds are redistributed to states with ratios greater than .6. This included 21 states whose per capita personal income is below that of the nation. This results because there are a number of states with allotment ratios well in excess of .6 and fewer states with ratios only slightly less than .4. Furthermore, applying constraints to the allotment ratio in an attempt to limit the degree of equalization has the perverse effect of eliminating equalization among the two groups of states affected by the constraints. For example, West Virginia and Mississippi receive the same amount of federal aid per unit of program need despite a large difference in per capita personal income; West Virginia's is 75 percent of the nation's whereas Mississippi's is only 55 percent. If a lesser degree of equalization is desired for political reasons, it would be more rational to change the parameters of the allotment ratio function rather than impose constraints on the ratios themselves.* A linear function with a lesser slope would limit the degree of equalization by compressing the range of allotment ratios. By choosing appropriate parameters, the entire range of allotment ratios could be, for example, set within the limits of .4 and .6 without the distortion that arises when constraints are imposed.†

Equalization should be thought of in a broader sense than simply the allotment of a federal appropriation among the states. The Vocational Education Act of 1963 requires states to match federal funds at least dollar for dollar. This requirement perverts the equalization contained in the allotment formula. Poor states that receive more federal funds per unit of program need are required to raise relatively more funds from state and local sources.

The proper measure of fiscal capacity to be used in the equalization provision of many grant-in-aid programs is a separate issue that cannot be considered within the limitations of this paper.[49]

Expenditures

The initial fiscal response to the Vocational Education Act of 1963 is depicted by the aggregate data shown in Figure IV-6. More than $100 million in federal funds were expended for the six purposes specified in the 1963 Act. An additional $197 million in state and local government funds were reportedly spent for these purposes. (These two sums are in addition to $54 million federal and $251 million state-local expenditures under the Smith-Hughes and George-Barden Acts.) The entire $197 million spent by states and localities should not be interpreted as additional spending stimulated by the 1963 Act. Reported state-local expenditures under the Smith-Hughes and George-Barden Acts declined by $27 million in 1965; this was the first year-to-year decline in the postwar period.

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* The legislative history of the Vocational Education Act of 1963 indicates that the imposition of the constraints of .4 and .6 on the allotment ratio was a compromise in Conference Committee between the Senate version, which set constraints at .25 and .75 (which in effect is no different than the unconstrained linear function) and the House version, which did not include an equalization provisision. Reference 46, pp. 55-6.

† The formula $A = (.722 - .222R)$ would serve this purpose when the poorest state has a value of R equal to .55.

Presumably these funds were used to match federal allotments under the new act. In addition, the total should be offset by the normal increase in state-local spending under the Smith-Hughes and George-Barden Acts; that increase was $23 million in 1964 and $22 million in 1963. The $197 million figure also includes $42 million in state-local expenditures for office occupations, a type of vocational education long supported by states and localities but eligible for federal aid for the first time in 1965. Another $65 million represents state-local matching funds for construction, some of which would have been spent despite the availability of federal support. Thus the amount of state-local expenditures stimulated by the first-year allotments under the 1963 Act was probably less than the federal funds spent.

Enrollments might be used to measure response, but reported enrollment data cannot be used for analytical purposes. Yet it is interesting to note that of the 864,221 increase in total enrollment between 1964 and 1965, 730,904 was in office occupations. The difference of 133,817 is considerably less than the reported growth in enrollment of 349,202 between 1963 and 1964. To interpret the initial response to the Vocational Education Act of 1963 better, data for individual states must be examined.*

The officials responsible for vocational education in each state were required to make a series of decisions in response to the allotment of additional federal funds that each state received for the first time in FY 1965. Some fiscal results of these decisions are summarized in Tables IV-17 and IV-18. The first of these lists the basic allotment received by each state under Section 3 of the 1963 Act. Seven states released some or all of their allotments to be reallotted to other states by OE. Seventeen states received reallotments, and $35,000 of the released funds were not reallotted and reverted to the U.S. Treasury. Several states transferred Smith-Hughes or George-Barden funds to be added to their 1963 Act allotments. In Connecticut, for example, all Smith-Hughes and George-Barden allotments, with the exception of George-Barden funds for home economics, were transferred. The fourth column in Table IV-17 lists the final amount of federal funds available in each state to be used for the purposes set forth in the Vocational Education Act of 1963. Five states--Montana, Wyoming, Guam, Virgin Islands, and American Samoa--made no expenditures of 1963 Act funds as indicated in column five. In the sixth column, the ratios of expenditures to total funds available are listed. More than half the states spent the entire amount of federal funds available to them. Funds available but not spent in the remaining states reverted to the Treasury; this amounted to 7.6 percent of the total

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* For a discussion of the initial response to the 1963 Act, which fails to consider some of the points raised in these two paragraphs, see Reference 3, pp. 30-71

Table IV-17

BASIC ALLOTMENTS, REALLOTMENTS, TRANSFERS, AND EXPENDITURES OF SECTION 4 FUNDS OF THE VOCATIONAL EDUCATION ACT OF 1963, BY STATE

1965

(Thousands of Dollars)

	Section 4 Basic Allotment	Reallotment (+ or -)	Transferred from Smith-Hughes and George-Barden Acts	Total Section 4 Funds Available	Section 4 Funds Spent	Section 4 Funds Spent as a Percent of Funds Available
Alabama	$ 2,468	$	$	$ 2,468	$ 2,129	86.3
Alaska	127			127	4	3.1
Arizona	977			977	803	82.2
Arkansas	1,382	-309		1,073	940	87.6
California	7,773	+320		8,093	8,093	100.0
Colorado	1,061			1,061	926	87.3
Connecticut	1,155	+48	474	1,677	1,676	100.0
Delaware	208			208	14	6.7
Washington, D.C.	314			314	308	98.1
Florida	3,346			3,346	2,514	75.1
Georgia	3,117		3	3,120	3,120	100.0
Hawaii	442			442	438	99.1
Idaho	485	+20		505	505	100.0
Illinois	4,340			4,340	3,024	69.7
Indiana	2,639			2,639	2,639	100.0
Iowa	1,592		16	1,608	981	61.0
Kansas	1,293			1,293	1,265	97.8
Kentucky	2,255	+93	254	2,602	2,601	100.0
Louisiana	2,395			2,395	1,261	52.7
Maine	659			659	184	27.9
Maryland	1,688		97	1,785	1,665	93.3
Massachusetts	2,377			2,377	2,377	100.0
Michigan	4,234			4,234	4,233	100.0
Minnesota	1,975	+81	50	2,106	2,106	100.0
Mississippi	1,719	+71		1,790	1,790	100.0
Missouri	2,326			2,326	1,217	52.3
Montana	486	-405		81	0	0
Nebraska	831			831	566	68.1
Nevada	178	+7		185	186	100.0
New Hampshire	381	+16	146	543	406	74.8
New Jersey	2,784	+115	8	2,907	2,906	100.0
New Mexico	695	+29		724	723	100.0
New York	7,400	+305		7,705	7,705	100.0
North Carolina	3,646	+2		3,648	3,648	100.0
North Dakota	450			450	450	100.0
Ohio	5,186	+214		5,400	5,399	100.0
Oklahoma	1,676	+69		1,745	1,744	100.0
Oregon	1,043		235	1,278	1,278	100.0
Pennsylvania	6,054			6,054	6,054	100.0
Rhode Island	495	+20	79	594	594	100.0
South Carolina	1,972			1,972	1,972	100.0
South Dakota	458			458	330	72.1
Tennessee	2,690		121	2,811	2,728	97.0
Texas	6,726			6,726	6,357	94.5
Utah	652	+27		679	679	100.0
Vermont	264			264	176	66.7
Virginia	3,034	-400		2,634	2,241	85.1
Washington	1,613			1,613	1,613	100.0
West Virginia	1,305	-217		1,088	1,088.	100.0
Wisconsin	2,245	+92	1	2,338	2,338	100.0
Wyoming	197	-197		0	0	0
Guam	48			48	0	0
Puerto Rico	1,807		500	2,307	2,307	100.0
Virgin Islands	22	-22		0	0	0
American Samoa	14	-14		0	0	0
Total United States	$106,650	$ -35	$1,984	$108,599	$100,309	92.4

Sources: Based on state reports for fiscal 1965. Preliminary data provided by the Division of Vocational and Technical Education, U.S. Office of Education.

Table IV-18

DISTRIBUTION OF EXPENDITURES UNDER THE VOCATIONAL EDUCATION ACT OF 1963 BY PURPOSE
(Percent)
1965

	Secondary	Post-secondary	Adult	Students with Special Needs	Ancillary	Construction
Alabama	2.9%	0 %	0 %	0 %	0.1%	96.5%
Alaska	12.7	82.7	0	0	3.2	0
Arizona	44.4	47.8	1.8	0.1	4.9	0
Arkansas	1.2	3.2	0.6	0.4	4.6	90.7
California	46.0	19.3	7.9	1.1	6.6	18.9
Colorado	40.1	19.1	2.2	1.8	3.7	32.9
Connecticut	49.4	33.4	1.9	0.1	14.2	0
Delaware	100.0	0	0	0	0	0
Washington, D.C.	34.1	18.7	0	1.2	26.6	15.9
Florida	47.5	32.7	14.0	0.8	3.5	2.0
Georgia	8.7	1.9	45.1	1.0	0.9	42.0
Hawaii	42.3	31.2	0	0	2.9	22.8
Idaho	49.5	40.2	2.8	0	3.5	3.9
Illinois	76.5	1.3	7.3	2.0	12.6	0
Indiana	12.0	0	1.0	0	0	86.7
Iowa	44.0	37.5	13.8	0	5.6	0
Kansas	26.1	7.2	0	0	11.2	55.5
Kentucky	24.2	0	17.1	0	4.0	54.7
Louisiana	0	39.0	52.4	0	7.4	0
Maine	20.1	79.9	0	0	0	0
Maryland	20.9	0.5	1.2	*	2.6	74.9
Massachusetts	48.8	2.4	5.5	0.3	2.6	29.8
Michigan	40.7	14.6	0	0	5.0	37.3
Minnesota	6.4	15.4	3.4	0.4	12.6	60.8
Mississippi	38.9	21.1	2.6	0	7.7	29.5
Missouri	59.4	5.3	1.8	0.2	3.1	29.8
Nebraska	18.0	2.5	3.2	0	3.0	73.0
Nevada	24.2	7.5	*	*	3.8	63.9
New Hampshire	6.2	1.5	0	0	3.7	88.7
New Jersey	42.8	0.1	6.3	0.1	6.3	42.1
New Mexico	39.7	5.1	2.0	0.9	12.0	39.7
New York	62.0	34.6	0.3	0	3.1	0
North Carolina	60.8	2.3	0.2	0.1	3.5	33.3
North Dakota	6.7	19.6	2.4	0	2.0	69.1
Ohio	11.0	0.9	2.5	0.2	1.5	83.9
Oklahoma	36.1	5.0	1.2	0	6.1	50.8
Oregon	22.1	24.1	1.5	0	10.7	41.5
Pennsylvania	32.0	2.0	*	0	4.8	61.2
Rhode Island	0	0	0	0	3.0	97.0
South Carolina	20.8	0	33.1	0	4.8	41.3
South Dakota	2.4	6.7	0	0	0	90.9

Table IV-18 (concluded)

	Secondary	Postsecondary	Adult	Students with Special Needs	Ancillary	Construction
Tennessee	13.7%	33.5%	1.5%	0	4.4%	46.7%
Texas	3.5	1.4	0.8	1.0	1.7	91.6
Utah	18.7	20.9	2.7	0	18.4	39.0
Vermont	22.7	5.6	0.6	0	6.8	64.8
Virginia	55.6	21.1	4.3	0	3.2	15.9
Washington	18.2	33.4	20.9	0	27.5	0
West Virginia	18.2	2.9	0	0.1	0.7	80.0
Wisconsin	10.3	38.9	5.1	0	8.2	37.5
Puerto Rico	27.3	9.1	0.9	0.5	3.1	59.2
United States	32.3	13.4	6.1	0.3	5.2	42.6

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* Less than 0.05 but not zero.

Source: Based on state reports for fiscal 1965. Preliminary data provided by the Division of Vocational and Technical Education, U.S. Office of Education.

available to all states. In only one instance, New Hampshire, did a state receive a reallotment of 1963 Act funds and then not spend the full amount of federal funds available.

The transfer provision of the 1963 Vocational Education Act enabled states to shift Smith-Hughes and George-Barden allotments from one specific program area to another as well as to the 1963 Act. Although all the transfers of Smith-Hughes allotments were to the 1963 Act, a total of $209,859 of George-Barden allotments was transferred between program areas. Given the new transfer provision, the only reason for a state to release allotments is its inability to match the federal funds. The amount of Smith-Hughes and George-Barden allotments released by states in 1965 was $0.5 million, whereas $1.8 million was released in 1964. One would expect an even further decline in the amount of Smith-Hughes and George-Barden funds released in the future as states adjust their administrative practices to the transfer provision of the 1963 Act. Some states released funds in one program area and received reallotted funds in another. For example, California released all of its $29,448 fishery allotment and received George-Barden Title II and III reallotments plus a reallotment of 1963 Act funds; South Carolina released more George-Barden Title II funds ($29,000) than it received in Title III reallotments ($18,053). Neither California nor South Carolina was among the 17 states that took advantage of the transfer provision in 1965.

The total expenditures of federal funds listed for each state in column five of Table IV-17 were distributed among the six purposes specified in the 1963 Act. This distribution, in percentage, is listed in Table IV-18. The distribution by purpose for the United States cannot be interpreted as a reflection of the distribution for a typical state. Even though 43 percent of the federal 1963 Act funds spent by all the states went for construction, ten states had no expenditure for this purpose and five states used more than 90 percent of the new federal aid for construction. All the states appear to have met the requirement of the Act that at least one-third of each state's allotment be used only for construction or postsecondary vocational education. In the case of Illinois, 1.3 percent of expended federal funds went for postsecondary and none for construction, and the requirement of the act was not met because 68.8 percent of Illinois' allotment was spent on the other four purposes. The 30.3 percent of Illinois' allotment that was neither spent nor released for reallotment reverted to the U.S. Treasury. The 1963 Act also requires states to spend 3 percent of their allotments only for ancillary services. Six states expended their entire federal allotments but did not meet this requirement. Presumably, they took advantage of the provision in the act that the U.S. Commissioner of Education "may, upon the request of a State, permit such State to use a smaller percentage of its allotment for any year for [this purpose] if he determines that such smaller percentage will adequately meet such [purpose] in such State."

The expenditure of federal funds can also be classified by program and by function. The largest portion of 1963 Act expenditures (excluding construction) was devoted to trades and industry. The second largest portion was used for training in office occupations, a program area not previously eligible for federal support. The third largest portion was devoted to technical education. In general, those states that had developed strong programs in technical education since the inception of Title III of the George-Barden Act in 1959 spent a substantial part of their 1963 Act allotments on this program. Those states that had weak programs spent little if any of their 1963 Act money on technical education and in some cases transferred their Title III funds to other allotment categories.

The breakdown of federal expenditures by function is available for all three federal acts combined. About a quarter of all federal funds were used to buy instructional equipment. In addition to this expenditure of $36 million, another $22 million of state-local spending for instructional equipment was reported. This is in sharp contrast to the $12 million combined federal and state-local spending for this function reported in each of the two previous years.

The fiscal response in each state to the 1963 Act can also be examined in terms of matching the ratios of state-local expenditures to federal expenditures. These ratios are listed in the first column of Table IV-19. To satisfy the matching requirement in the legislation, all these ratios must be at least 1.00. Two adjustments to these ratios were made. Account was first taken of the 1965 reduction in state-local expenditures declared as matching funds for the Smith-Hughes and George-Barden allotments. Such reductions took place in a majority of the states. Secondly, the ratios were adjusted for reported state-local spending for office occupations on the assumption that this represented a continuation of support for long-standing programs. Again such adjustments were made for a majority of the states. For example, New York reported $20.6 million of state-local expenditures for office occupations. This was in "response" to a $1.0 million expenditure of federal funds, practically all of which was spent on instructional equipment. When both adjustments were made, 22 states had ratios of less than 1.00. In Illinois and Washington, the adjusted ratio is negative indicating that reported matching funds for the 1963 Act were more than offset by reductions in state-local expenditures matching Smith-Hughes and George-Barden allotments and state-local expenditures for office occupations.

Recommendations

The list of recommendations below stems from the above analysis of the intergovernmental fiscal relations associated with the federal grant-in-aid program for vocational education.

1. All federal aid for vocational education should be consolidated under the Vocational Education Act of 1963. The ten separate allotments under the Smith-Hughes and George-Barden Acts create an unnecessary administrative burden on federal, state, and local officials. The allotment procedures of these acts are

Table IV-19

RATIO OF REPORTED STATE-LOCAL EXPENDITURES TO FEDERAL EXPENDITURES FOR 1963 ACT PURPOSES AND ADJUSTMENTS FOR REDUCTIONS IN REPORTED STATE-LOCAL SMITH-HUGHES AND GEORGE-BARDEN ACT EXPENDITURES AND FOR OFFICE OCCUPATION EXPENDITURES, BY STATE

1965

		Adjustment in Ratio Due To		
	Ratio of State-Local Expenditures to Federal Expenditures	Reduction in Smith-Hughes and George-Barden Act Expenditures*	Office Occupation Expenditures	Adjusted Ratio
Alabama	1.00			1.00
Alaska	1.00			1.00
Arizona	1.15	0.32	0.10	0.73
Arkansas	1.04	0.03		1.01
California	2.04	0.64		1.40
Colorado	1.31	0.41	0.23	0.67
Connecticut	3.51	1.35		2.16
Delaware	1.00			1.00
Washington, D.C.	1.08	0.46	0.08	0.54
Florida	1.69	0.70	0.58	0.41
Georgia	1.24		0.17	1.07
Hawaii	1.40	0.34	0.75	0.31
Idaho	1.32	1.05	0.09	0.18
Illinois	1.50	1.45	0.50	-0.45
Indiana	1.00			1.00
Iowa	1.14	0.51	0.12	0.51
Kansas	1.21		0.16	1.05
Kentucky	1.03	-0.07	0.21	0.89
Louisiana	1.08		0.23	0.85
Maine	1.04			1.04
Maryland	2.57		0.10	2.47
Massachusetts	3.67	2.75		0.92
Michigan	1.00		0.18	0.82
Minnesota	3.25		0.14	3.11
Mississippi	1.44	0.21		1.23
Missouri	1.02		0.31	0.71
Nebraska	1.00			1.00
Nevada	1.10		0.09	1.01
New Hampshire	3.58	-1.46		5.04
New Jersey	2.14	0.75	0.53	0.86
New Mexico	1.60	0.21	0.48	0.91
New York	5.46	0.80	2.66	1.00
North Carolina	2.81	1.40		1.41
North Dakota	1.13	0.20	0.10	0.83
Ohio	1.07		0.10	0.97
Oklahoma	1.10	0.16	0.02	0.92

Table IV-19 (concluded)

	Ratio of State-Local Expenditures to Federal Expenditures	Adjustment in Ratio Due To		Adjusted Ratio
		Reduction in Smith-Hughes and George-Barden Act Expenditures*	Office Occupation Expenditures	
Oregon	1.50	-0.50	0.39	1.16
Pennsylvania	2.04		0.21	1.83
Rhode Island	1.39			1.39
South Carolina	1.39	0.57	0.21	0.51
South Dakota	1.00			1.00
Tennessee	1.36	0.06	0.14	1.16
Texas	1.07			1.07
Utah	3.94	0.62	0.32	3.00
Vermont	1.09		0.05	1.04
Virginia	1.15	0.29	0.56	0.30
Washington	1.41	1.28	0.36	-0.23
West Virginia	1.00		0.09	0.91
Wisconsin	2.82	0.34	0.49	1.99
Puerto Rico	1.42		0.12	1.30
United States	1.96	0.23	0.41	1.32

* The figures listed in this column are the differences between those in the first column and the ratio of 1965 state-local expenditures for 1963 Act purposes minus reductions between 1964 and 1965 in state-local expenditures for Smith-Hughes and George-Barden Acts to 1965 expenditures of federal funds for 1963 Act purposes minus Smith-Hughes and George-Barden federal allotments transferred to the 1963 Act.

Sources: Based on state reports for fiscal 1965. Preliminary data provided by the Division of Vocational and Technical Education, U.S. Office of Education.

rigid and in some cases, inappropriate. The transfer provision included in the 1963 Act now enables states to ignore the purposes for which these funds were originally intended. The aggregate amount of these appropriations should be added to the allotments under the 1963 Act. The only purpose for which some Smith-Hughes and George-Barden funds can be used that is not permissible under the 1963 Act is support of nonwage-oriented home economics. If Congress deems continued federal support of this type of education to be essential to the achievement of national educational objectives, states could be permitted to use a certain portion of their allotments under the 1963 Act for this purpose. If, as recommended, Smith-Hughes and George-Barden allotments for specific program areas are dropped, all federal expenditures would have to be matched in terms of the six purposes set forth in the 1963 Act.

2. If the Smith-Hughes Act and Title I of the George-Barden Act are retained, state allotments should be based on annual estimates of the specific population data now used decennially.

3. If Titles II and III of the George-Barden Act (health occupations and technical education) are retained, federal appropriations for these program areas should be allotted among the states on the basis of annual state shares of total population and employment in manufacturing, respectively.

4. The population estimates used in the 1963 Act allotment formula should be adjusted to reflect better the potential number of vocational education students in each state by adjusting for military personnel and students enrolled in nonpublic institutions and four-year colleges and universities.

5. The allotment ratios used to accomplish equalization in the 1963 Act allotment formula should be unconstrained. This would better reflect state differences although it would only increase the amount of equalization from about 6 to about 7 percent of the total amount allotted among the states. The four outlying areas could be assigned ratios equal to that of the poorest state. Allotment ratio formulas could be specified to achieve whatever degree and amount of equalization desired by Congress.

6. The matching requirement for those states that are allotted additional federal funds as a result of the equalization process should be eased. The suggested change is to make the matching ratio equal to the ratio of the allotment without equalization to the allotment with equalization for a state whose allotment is increased as a result of the equalization provision. For such a state, which spends all of its federal funds, the amount of state-local expenditures required for matching purposes would equal the state's allotment without equalization.

PART V: CONDUCT OF SYSTEMS ANALYSIS

Chapter 15

INTRODUCTION AND SUMMARY

Systems analysis is an integral part of a PPB system. Systems analysis is explicit, quantitative analysis that is designed to help decision-makers maximize benefits for a given level of costs or to minimize costs for a given level of benefits. It includes techniques of benefit/cost analysis, effectiveness/cost analysis, operations research, and other related techniques applicable to the planning and decision-making process.

Benefit/Cost and Effectiveness/Cost Analysis

Benefit/cost analysis treats of monetary indices of program performance, while effectiveness/cost analysis is more general and thus can have monetary or nonmonetary indices of performance, such as graduates placed in jobs or scholastic achievement scores. As the paper in Part IV by Charles Hitch indicates, the evaluation of programs by using techniques of effectiveness/cost and benefit/cost analyses can provide valuable assistance to educational managers and administrators.

The application of these techniques of economic analysis to education and other investments in human resources is a relatively new area of research among professional economists. The reconnaissance survey indicated that its use is practically nonexistent by educators and other professionals concerned with education. No benefit/cost or effectiveness/cost analysis was being conducted by either the states or communities surveyed. Only a few had any intentions of conducting such economic analysis in the future.

The possible reasons for this are several. First, the analysis of benefits or effectiveness as related to costs in the public sector of the economy is a relatively new technique. In the private sector, the operation of the marketplace proceeds with numerous individual buyers and sellers making their own decisions as to benefits and costs and freely arriving at effective transaction prices. In the absence of such a freely working marketplace in the public sector, it is necessary to simulate such conditions to avoid waste of funds and maximize returns from government-controlled revenue. Such analysis is essential to assist choice or to set priorities among various programs, their objectives, and alternative courses of action to achieve them. Systems analysis provides a manner of introducing a more rigorous or disciplined approach to decision-making into the public sector similar to that of the free market forces in the private sector.

Second, there has only recently been an awareness of the significant impact of education on economic growth. Studies quoted by Robert Spiegelman indicate that 42 percent of the growth in per capita income in the United States during 1929-56 is due to education.

Third, there has been a real but unwarranted fear among educators that the application of economic analysis to education would result in what Ernst Stromsdorfer refers to as "the secularization of the sacred." Unwarranted comparisons between education and other social programs have added to this concern. For instance, a benefit/cost ratio of approximately 1350 to 1 has been estimated for a program to promote the use of seat belts, a ratio of 9 to 1 for the care of uterine cervix cancer, and a ratio lying between 1.5 to 1 and 3 to 1 for vocational education. This does not dictate the restriction of resources to vocational education in favor of expanding expenditure on propogating the use of seat belts, since the two programs are essentially noncomparable. Such economic analysis is most relevant when alternative approaches to achieve the same objective within a program are being weighed.

In the discussion of the program budget that appears in Part IV, the favorable seat belt education benefit/cost ratio was compared with less favorable ratios coming out of the initial studies of vocational education. Data supplied by the Department of Health, Education, and Welfare showed that the costs of seat belt education included only the training costs and excluded the costs of seat belt production and installation. Vocational education studies, on the other hand, included total costs. On the benefit side, seat belt education claimed indirect monetary benefits based on deaths and injuries averted, while vocational education attempted to measure direct benefits of the net increase in the income stream due to the training program. Benefits excluded from the latter measurement included those that would derive from reduction of unemployment and social tensions of the kind that contribute to riots in urban cities, reduction of juvenile delinquency and crime, and reduction of other social costs. Obviously, these two programs are not comparable on the basis of the components of costs and benefits and cannot be validly compared for purposes of decision-making in the allocation of resources.

Lack of communication between educational decision-makers and economists has been another major reason for the lack of use of economic analysis. Decision-makers must acquire an awareness of the efficacy of economic analysis in helping to solve their ongoing problems. This research report represents a step in that direction. A further positive step would be the construction of an economic guide for the evaluation of human resource development programs, including education and training. Such a guide already exists for federal government investment in water resources projects, which was prepared and issued by an interagency committee.[50]

Serious economic questions exist for the field of secondary education. Most studies indicate that vocational education costs about twice as much as other secondary education. Yet, thus far, research also indicates that the monetary benefits are similar for the major secondary education curricula. If other things are equal, and monetary benefits are accepted as a proper performance index, then if vocational education and other secondary education are close substitutes for each other, both from society's and the individual's viewpoint, educational resources are being badly allocated. Greater educational benefits in monetary terms could be gained by shifting resources away from vocational education in high schools to other types of education, perhaps toward academic programs or work-study programs using the capital facilities of employers. However, the few benefit/cost studies being done to date on vocational education suffer from a variety of data and methodological shortcomings. Also, they are case studies and thus lack generality.

The papers in this section represent an attempt to clarify further the theoretical and methodological issues entailed in an economic analysis of vocational education. "Benefit/Cost Analysis of Vocational Education: A Survey," by Bruce Davie discusses the major economic analysis performed on vocational education to date. This paper highlights the practical difficulties facing the researcher undertaking such analysis. "Economic Concepts and Criteria for Investment in Vocational Education" by Ernst Stromsdorfer discusses the general theoretical and methodological issues of benefit/cost analysis. "A Benefit/Cost Framework for Education" by Robert G. Spiegelman spells out in detail the major quantitative relationships that must be considered. Finally, "A Summary Guide for Benefit/Cost Analysis" by Einar Hardin reiterates the major factors one must consider in any benefit/cost or effectiveness/cost analysis.

Chapter 16

BENEFIT/COST ANALYSIS OF VOCATIONAL EDUCATION: A SURVEY

By

Bruce F. Davie

Background

The literature dealing with the application of benefit/cost analysis to vocational education and to training programs is widely scattered in special research reports, journal articles, conference proceedings, and unpublished papers. For the purposes of this survey, the literature can be divided into two categories--theoretical-methodological and empirical. The former category is the most extensive, undoubtedly because economists familiar with the use of benefit/cost analysis in other areas have, with relative ease, been able to identify the major theoretical and methodological issues involved and even reveal additional subtleties, whereas work in the latter category is hard, time consuming, and expensive--and thus scarce. Most of the empirical work has been directed toward the evaluation of training and retraining programs rather than secondary and postsecondary vocational education.

The Elements of Benefit/Cost Analysis

The major issues raised in both the theoretical-methodological and empirical literature are abbreviated and organized in Figure V-1, where benefits, costs, time horizon, risk, and discount rates are listed both from the societal and individual viewpoint. This division is essential since differences may well be so significant that a particular program could be judged socially desirable using benefit/cost analysis but individuals would not enroll acting in response to their own rational comparison of benefits and costs. In both cases, benefits and costs have been listed roughly in order of importance. No attempt has been made to attribute particular ideas to individual authors (see the attached bibliography). Such an attribution is virtually impossible given the fragmented nature of the literature and the fact that most authors have discussed most of these items.

The discussion of the individual items listed in Figure V-1 can be quite brief since most of them are analyzed in Dr. Stromsdorfer's paper. Two points require some additional emphasis. First, while transfer payments merely represent income redistribution from the societal viewpoint, they are included in the individual's evaluation of benefits and costs. If, as a result of a vocational education program, an individual increases

Figure V-1

THE ELEMENTS OF BENEFIT/COST ANALYSIS

Element	Society	Individual
Benefits	1. Additional earnings attributable to occupational education (gross of taxes). 2. Other additional income (output) attributable to occupational education (gross of taxes). a. To cover costs of fringe benefits. b. Rendering other factors of production more productive. c. Increasing productivity of future generations as the better educated induce their progeny to become better educated. d. Benefits of future educational programs undertaken as a result of the current programs. 3. The effects of reducing transfer payments. a. The additional income generated by resources released from administration of transfer programs. b. Additional income as disincentive effects of taxes necessary to finance transfers are removed. 4. Better citizenship and reduced costs to society of bad citizenship.	1. Additional earnings attributable to occupational education (net of taxes). 2. Fringe benefits associated with additional earnings. 3. Stipends received (if any) while enrolled in occupational education program. 4. Value of the option to enter other educational programs in the future. 5. Increased psychic income.

Figure V-1 (concluded)

Element	Society	Individual
Costs	1. Opportunity costs (gross of taxes).	1. Opportunity costs (net of taxes).
	2. Operating expenses of educational agency.	2. Loss of transfer payments.
	3. Capital expenses of educational agency.	3. Tuition (if any).
	4. Costs to other public agencies.	4. Out-of-pocket expenses associated with enrollment.
	5. Induced reductions in income (gross of taxes). a. Of workers displaced (in the absence of full employment) by program graduates. b. Of family members.	5. Induced reductions in family income (net of taxes).
Discount Rate	Social discount rate	1. Lending rate 2. Borrowing rate (may be an increasing function of the amount borrowed) 3. Personal rate of time preference
Time Horizon	Infinite (if effects on future generations are to be considered)	Lifetime
Certainty of Measurement	Some data known with certainty or based on averages derived from a large number of cases. Other data estimated.	Most data uncertain. Likelihood of risk aversion.

his earned income to the extent that he no longer receives transfer payments he will treat the foregone receipts as a cost. Similarly, he will treat any stipend received while enrolled in the program as a benefit. Second, the increased earnings of graduates of vocational-technical education programs may have an induced effect on the labor force participation of other members of the household, which would have to be included in costs both from the individual and societal points of view. For example, if a husband experiences increased income as a result of a training program the wife may withdraw from the labor force.

Setting forth the elements of benefit/cost analysis separately for society and for the individual suggests situations where particular programs would be judged desirable for society but undesirable for the individual.* Where operating and capital costs are relatively high and no tuition is charged, individuals may be attracted to a program where societal benefits would not justify societal costs. Conversely, when reduced transfer payments are a significant consideration for individuals who use (probably only implicitly) high discount rates, programs that are desired by society will not attract enrollees. Such a situation might call for the payment of stipends or continued transfer payments. The difficulty in establishing occupational training programs for mothers who receive ADC payments illustrates this point.

In most cases, the ratio of benefits to costs is the most appropriate criterion to use in planning or evaluating vocational-technical education programs. Figure V-2 presents the case in terms of an example carefully prepared to show the essential difference between the present value of net benefits and rate of return criteria, discussed in Professor Stromsdorfer's paper, and the benefit/cost ratio criterion. If it is assumed that projects A, B, and C are not mutually exclusive and further that they are reproducible, then, given any constraint on the budget available to finance costs at t = o, the benefit/cost ratio criterion leads to maximizing the present value of net benefits for a set of programs within the limits imposed by the budgetary constraint. For example, in Figure V-2 if the constraint were $400, eight program Cs would be best. (If an individual were choosing among the three programs he would consider them mutually exclusive and would enroll in A.) It is precisely because the benefit/cost ratio technique focuses on the relative differences between benefits and costs that it is generally to be preferred for this purpose over either the net present value or the rate of return criteria, both of which are based on the absolute differences between benefits and costs.

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* Ernst Stromsdorfer's suggestion that the analysis be done for particular units of government as well is interesting. Where programs are desirable from the societal viewpoint but not from that of the relevant unit of government, a case can be made for financial support from a higher level of government.

Figure V-2

COMPARISON OF THREE EVALUATION TECHNIQUES

The Three Criteria

I Present Value of Net Benefits: $\sum_{t=o}^{n} \frac{B_t - C_t}{(1 + i)^t}$

II Rate of Return: $\sum_{t=o}^{n} \frac{B_t - C_t}{(1 + r)^t} = 0$

III Benefit Cost Ratio: $$\frac{\sum_{t=o}^{n} \frac{B_t}{(1 + i)^t}}{\sum_{t=o}^{n} \frac{C_t}{(1 + i)^t}}$$

where B_t = benefits in year t
C_t = costs in year t
n = number of years spanned by the analysis
i = social discount rate
r = rate of return

The Three Decision Rules

I Choose programs having the highest present values of net benefits; reject any program having a negative present value of net benefits.

II Choose programs having the highest rates of return; reject any program which has a rate of return less than the social discount rate.

III Choose programs having the highest benefit-cost ratios; reject any program having a benefit cost ratio less than one.

The Example (i = 5%)

Program	Cost	Benefits		Criteria Measure		
	t = o	t = 1	t = 2	I	II	III
A	$200.00	$106.00	$112.36	$2.86	r = 6 %	1.014
B	100.00	107.00	0	1.90	r = 7	1.019
C	50.00	0	57.14	1.20	r = 6.9	1.024

Figure V-2 (concluded)

Program A is preferred using Criterion I; Program B is ranked higher than Program C.
Program B is preferred using Criterion II; Program C is ranked higher than Program A.
Program C is preferred using Criterion III; Program B is ranked higher than Program A.

Equity as a Criterion in Evaluation

If planning decisions and evaluations were made purely in terms of benefit/cost analysis, as discussed above, educational resources would be allocated more efficiently, but there is no presumption that the societal objective of equality of educational opportunity would be met. This latter concept is difficult to specify in an operational sense although it is clear that equating the marginal benefits per dollar of cost of occupational education programs is not equivalent to providing equal opportunity of occupational education. Societal objectives with respect to income distribution may even differ from equality of educational opportunity.

There are at least two possible methods of explicitly considering income distribution in an analysis of vocational-technical education. One would attach a set of weights to the additions to income attributable to occupational education. Thus, an additional $1,000 of income per year would be weighted more heavily in the case of an individual whose income was increased from $4,000 to $5,000 than for an individual whose income increased from $10,000 to $11,000. Any such set of weights would naturally be highly arbitrary unless one concluded that the marginal tax rates used in the federal personal income tax reflect a societal judgment with respect to the marginal utility of income. The second method would require a local school agency to plan and evaluate vocational-technical education using effectiveness/cost rather than benefit/cost analysis. Minimization of the dropout rate could be taken as a goal, and programs could be selected to equate marginal reductions in the dropout rate per dollar of cost. An alternative goal on which to base effectiveness/cost analysis might be an explicit income target for graduates such as maximizing the portion of graduates who earn say $5,000 per year. Individual programs would be judged in terms of the contribution made per dollar of cost toward achieving that goal. (At some point, educational decision-makers might conclude that a program costing $X that would increase the portion of graduates earning $5,000 per year from 80 to 81 percent is not to be preferred to a program also costing $X that increased the portion of graduates earning $6,000 per year from 60 to 65 percent.)

Questions of income distribution enter into the planning and evaluation of vocational-technical education in at least one other way. When employment is not full, graduates of occupational education programs may receive preferential treatment in the labor market, which is not necessarily attributable to their education. The resulting shift in the incidence of unemployment (and shifting of transfer payments) could only be judged in light of the change in the distribution of income.

Review of Three Studies

The three studies reviewed below were selected because of their focus on vocational-technical education at the secondary and postsecondary level; they represent the only completed work known to this author that attempts to measure the benefits of vocational-technical education. Several similar studies have been done of retraining programs.

Max Eninger's study[30] is not a benefit/cost study since it contains no cost information, but it does present extensive data concerning the postgraduation experience of vocational education graduates. These data were derived from survey questionnaires mailed in the fall of 1964 to about 10,000 male graduates from the classes of 1953, 1958, and 1962 at 100 high schools in 38 states. The 50 comprehensive and 50 vocational or technical schools, each of which offered at least three T & I (trade and industrial) courses, were selected on the basis of a stratified random sample. The strata were geographical regions, total school enrollment, and type of school, i.e., comprehensive, vocational, technical, and vocational-technical. Some of the data generated by the study are directly relevant to the problem of estimating the probable benefits of vocational education in terms of earnings.

The first finding of interest concerns the length of time required to find an initial job. The comparison shown in Table V-1 indicates that academic graduates spent a longer time between graduation and their first job than did vocational graduates. While the differences in mean values are statistically significant, the relatively large standard deviations indicate that the type of graduate probably explains a small portion of the total variation. The data listed in Table V-2 suggest that vocational graduates received significantly more help from the school system in landing their first job, thus, a large part of the differences reported in Table V-1 may be attributable to placement activities rather than type of education.

Closely related to the amount of time required to find an initial job is the total portion of time spent employed. The differences between vocational graduates and academic graduates without college experience is shown in Table V-3. Vocational graduates spent a smaller portion of their time since graduation unemployed. Although the difference narrowed with the passage of time, it was still statistically significant for the class of 1953. These data can be used along with the initial and present wage rates, reported in Table V-4, to estimate the differences between the present value of total earnings for vocational graduates and academic graduates who did not go on to college. Yearly income estimates were obtained by assuming a constant rate of growth between initial and present wage rates multiplied by 2,080 (hours per year) and by the portion of time employed, as reported in Table V-3. These yearly income estimates were then discounted at 5 percent back to the year of graduation and summed. For the class of 1953, the present value of the income of academic graduates exceeded that of vocational graduates by about $1,270. For 1958 graduates, the present value (at time of graduation) of the next six

Table V-1

MONTHS REQUIRED TO FIND INITIAL JOB: COMPARISON OF VOCATIONAL AND ACADEMIC GRADUATES

(Based on Cases That Went Directly to Work)

Year of Graduation	Type of Graduate	Number of Cases	Months	
			Mean	Standard Deviation
1953	Vocational	946	1.3	2.6
	Academic	175	2.6	4.8
1958	Vocational	1,193	2.3	4.0
	Academic	207	4.0	5.7
1962	Vocational	1,807	1.7	2.8
	Academic	256	2.8	4.3
Combined	Vocational	3,960	1.8	3.2
	Academic	638	3.1	5.0

Source: Reference 30, p.5-8.

Table V-2

METHODS USED TO GET FIRST FULL-TIME JOB, BY TYPE OF GRADUATE

Method	Type of Graduate			
	Vocational		Academic	
	Number	Percent	Number	Percent
Answering want ad	290	7.5%	27	5.6%
Private employment agency	69	1.8	18	3.8
State employment agency	203	5.2	36	7.5
Help of school teacher	696	17.9	9	1.9
Help of school counselor	206	5.3	3	0.6
Help of school principal	130	3.3	4	0.8
Help of school placement service	371	9.6	6	1.2
Help of relative or friend	1,485	38.2	251	52.5
Through school cooperative program	350	9.0	6	1.2
Other than above	857	22.1	133	27.8

Source: Reference 30, p. 5-38.

Table V-3

EMPLOYMENT SECURITY: COMPARISON OF VOCATIONAL AND ACADEMIC GRADUATES
(Based on Graduates with No College Education Who Have Approximately Six Months' Employable Time)

Year of Graduation	Type of Graduate	Number of Cases	Percent of Employable Time Employed	
			Mean	Standard Deviation
1953	Vocational	819	93.5%	14.4%
	Academic	149	89.6	20.0
1958	Vocational	1,188	88.0	19.5
	Academic	212	83.2	21.4
1962	Vocational	1,528	85.0	22.1
	Academic	230	76.2	29.0
Combined	Vocational	3,548	88.0	19.9
	Academic	591	82.1	24.9

Source: Reference 30, p. 9-10.

Table V-4

WAGE RATES: COMPARISON OF VOCATIONAL AND ACADEMIC GRADUATES WITH NO COLLEGE EDUCATION

Year of Graduation	Type of Graduate	Number of Cases	Initial Wage Rates		Number of Cases	Present Wage Rates	
			Mean	Standard Deviation		Mean	Standard Deviation
1953	Vocational	826	$1.31	$0.49	822	$3.02	$0.95
	Academic	150	1.44	0.61	152	3.06	1.22
1958	Vocational	1,182	1.46	0.52	1,198	2.46	0.79
	Academic	215	1.48	0.55	221	2.35	0.88
1962	Vocational	1,504	1.46	0.56	1,536	2.01	0.70
	Academic	208	1.44	0.49	208	1.87	0.62
Combined	Vocational	3,524	1.43	0.53	3,568	2.40	0.89
	Academic	573	1.46	0.54	581	2.36	1.02

Source: Reference 30, pp. 9-44, 9-53

years of income for vocational graduates was about $3,450 in excess of that of academic graduates. For the class of 1962, the present value of the next two years of income for vocational graduates exceeded that of academic graduates by about $1,060. The appropriate conclusions to draw from these comparisons are not very clear. Either vocational education has improved since 1953 or the earnings advantage disappears over an 11-year period.

Two additional findings of the study are of interest in terms of the criteria that have traditionally been used to evaluate vocational-technical education. In all three of the graduating classes surveyed, more vocational graduates had an initial job that was "completely unrelated" to the trade that they had studied than in the "same trade," as indicated in Table V-5. These data do not conform to the placement rates of well over half widely mentioned in the vocational education literature[13], pp. 90-7. It is also argued in this literature that the equipment used in vocational-technical programs is obsolete in comparison to industry. Many vocational educators acted in accordance with this argument by devoting a major portion of federal aid under the Vocational Education Act of 1963 to equipment purchases, yet the data in Table V-6 suggest that graduates of T&I programs did not consider the schools too inadequate on these grounds.

There is considerable additional information contained in the report. The data, particularly in a raw form, could be used to test many interesting hypotheses, particularly hypotheses that permit multivariable analysis. It is to be hoped that additional study of these data will be undertaken although it is unfortunate that no cost information is available.

The study by Adger Carroll and Loren Ihnen,[51] was sponsored by the Office of Manpower Policy, Evaluation, and Research of the Department of Labor. Data were gathered from 45 male graduates of two-year postsecondary technical education programs at Gaston Technical Institute (Gastonia, North Carolina) and a control group of 45 North Carolina high school graduates who had academic records similar to those of Gaston Tech graduates. All of the high school graduates in the control group had no formal posthigh school education. Monthly income data were obtained for the 1957-64 period. Table V-7 shows the comparison in mean monthly incomes for Gaston Tech graduates and the control group suggesting a differential that grows over time. A multiple regression equation was estimated to account for the possible effect of other variables on earnings. The results are shown in Table V-8 but are difficult to interpret since only the one equation is presented rather than several via a technique such as stepwise regression, which would show the effect of different combinations of variables.* The coefficients for X_1, X_9, and X_{10} do however agree

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* It is not appropriate to treat each reported monthly income as a separate observation. The number of degrees of freedom is limited by the 90 individuals surveyed.

Table V-5

TREND IN NUMBER OF PERCENTAGE OF VOCATIONAL GRADUATES PLACED IN FOUR CATEGORIES OF RELATIONSHIP BETWEEN TRADE STUDIED AND FIRST FULL-TIME JOB

Relation of First Job to Trade Studied in High School	Year of Graduation							
	1953		1958		1962		Combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Same trade	301	32.6%	313	27.6%	498	29.6%	1,118	29.8%
Highly related trade	168	18.2	189	16.6	333	19.8	691	18.4
Slightly related trade	150	16.3	164	14.4	229	13.6	544	14.5
Completely unrelated trade	303	32.9	470	41.4	625	37.1	1,402	37.3

Source: Reference 30, p. 5-16.

Table V-6

TOOLS AND EQUIPMENT: COMPARABILITY ANALYSIS AND TIME REQUIRED TO LEARN TO USE VERY MUCH DIFFERENT TOOLS AND EQUIPMENT BY YEAR OF GRADUATION

	Year of Graduation							
	1953		1958		1962		Combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Tools and equipment compared with those used in school								
Identical or almost so	155	49.8%	182	52.8%	265	56.7	604	53.5%
Little real difference	122	39.2	132	38.3	161	34.5	418	37.0
Very much different	34	11.0	31	8.9	41	8.8	107	9.5
If very much different, time required to learn								
Only about a few weeks	13	39.4	10	37.0	3	43.6	41	41.0
Less than three months	6	18.2	5	18.5	17	23.1	20	20.0
About three to six months	8	24.2	6	22.2	9	7.7	17	17.0
About six months to a year	0	0.0	3	11.1	3	12.8	8	8.0
More than a year	6	18.2	3	11.1	5	12.8	14	14.0

Source: Reference 30, p. 6-3.

Table V-7

AVERAGE MONTHLY INCOMES OF GASTON TECH AND HIGH SCHOOL GRADUATES FOR SPECIFIED MONTHS AFTER GASTON TECH GRADUATES COMPLETED TECHNICAL SCHOOLING

	Gaston Tech		High School	
Month	Income (dollars)	Coefficient of Variation*	Income (dollars)	Coefficient of Variation*
2	$353	12.0	$315	33.1
14	404	12.3	331	29.9
26	442	14.5	351	29.2
38	483	14.8	370	28.9
50	516	17.0	405	25.6

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* The coefficient of variation is the standard deviation of monthly incomes expressed as a percentage of the mean.

Source: Reference 51, p. 23.

Table V-8

REGRESSION COEFFICIENTS AND STANDARD ERRORS*
(Dollars per Month)

Variable	Coefficient	Standard Error
X_1 - Technical education (1 for Gaston Tech, 0 for high school graduates)	$38.98†	$4.63
X_2 - High school grade average	15.76†	2.23
X_3 - Age-experience	18.38†	0.44
X_4 - Mother's education	9.43†	0.48
X_5 - Residence during high school (1 for urban, 0 for rural)	31.77†	2.53
X_6 - Military service	-1.53†	0.08
X_7 - Migration from home community	0.23†	0.03
X_8 - Size of high school class	-0.08†	0.01
X_9 - Trend - Gaston Tech (0 for high school graduates)	3.42†	0.09
X_{10} - Trend - high school (0 for Gaston Tech graduates)	2.30†	0.09

Constant term: -320.82

Standard error of regression ($Y.X_{1-10}$): 72.43

Fraction of total variation associated with regression (R^2): 0.55

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* Based on 4,759 observations of monthly income.

† Coefficients are significant at the .01 level.

Source: Reference 51, p. 26.

closely with the differences in simple average monthly incomes reported in Table V-7. Some evidence is also presented in the study to indicate that the graduates of the two-year technical education program also enjoyed greater fringe benefits than high school graduates.

Opportunity costs were estimated on the basis of the initial income experience of the high school graduates (corrected by the results of the multiple regression equation to fit the characteristics of the Gaston Tech graduates) less part-time earnings of the technical students. The costs of operating the technical education program were added to opportunity costs to estimate total social costs (see Table V-9). Combining these cost estimates with two alternative income projections (adjusted for mortality rates) yielded the rates of return listed in Table V-10. These rates of return are based on the supposition that the income advantage of the technical graduates will be maintained at the absolute level observed four years after graduation or will be increased. There appear to be no grounds for rejecting the possibility that the advantage might decline in the future even to the extent of being reversed.

The Carroll-Ihnen study is a good example of applying benefit/cost analysis to a specific educational program. It could have been improved with a more sophisticated multivariable analysis.* One wonders if there were significant differences, with respect to the income of graduates, between the four separate technical programs offered at Gaston Tech.

A. J. Corazzini's study[31] is another attempt to apply benefit/cost analysis to a specific vocational education program. Separate four-year vocational high schools, one for boys and one for girls, accounted for about 17 percent of the high school enrollment in Worcester during the 1963-64 school year. In addition, the Worcester Technical-Industrial Institute enrolled more than 200 students in 13th and 14th year programs, sharing facilities with the boys' vocational high school. About half of the students in the Institute were enrolled in the 11 trade programs offered for the high school students; the other half were enrolled in four technical programs.

After a general discussion of the economics of education and benefit/cost analysis--in which some confusion arises because unemployment and welfare payments are not treated as transfer payments and because taxes on additional income are double counted as a benefit over and above the additional income itself--Corazzini makes detailed estimates of the costs of Worcester's vocational education programs in comparison with costs at the regular high schools. These estimates are shown in Table V-11. Implicit rents were imputed for the vocational schools, following the format suggested by T. Schultz,[53] by (1) multiplying a 5.1 percent interest charge

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* For a somewhat similar analysis of the variables associated with the relative success of retrained workers in the labor market, see Reference 52.

Table V-9

AVERAGE PRIVATE AND PUBLIC COSTS PER GASTON TECH GRADUATE FOR TWO YEARS OF TECHNICAL SCHOOLING
(Dollars)

Type of Cost	First Year	Second Year	Totals
Private			
Tuition and fees	$ 272	$ 272	$ 544
Books and supplies	142	84	226
Foregone income*	1,896	2,254	4,150
Subtotal	$2,310	$2,610	$4,920
Public			
Support of the school (facilities, supplies, and personnel)	729	729	1,458
Transfer payments (G. I. Bill* and unemployment)	512	535	1,047
Subtotal	$1,241	$1,264	$2,505
Total	3,551	3,874	7,425

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* The sum of these two items represents income that would have been earned if student were fully employed, less actual part-time earnings.

Source: Reference 51, p. 36.

Table V-10

RATES OF RETURN AND BENEFIT/COST RATIOS ON INVESTMENT IN THE TECHNICAL EDUCATION OF GASTON TECH GRADUATES, BY PROJECTION

Investment	Rate of Return (percent) Projection 1*	 Projection 2†
Social	11.7%	16.5%
Private	16.9	22.0
Private‡	14.3	19.1
	Benefit/Cost Ratios	
Social		
3% discount rate	3.0	7.7
5% discount rate	2.3	5.1
8% discount rate	1.5	3.0

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* Assuming constant absolute differences in income of $1,036/year.
† Assuming differences in income to grow at 2%/year.
‡ Without G. I. Bill payments.

Source: Reference 51, p. 49.

times the "full fair market value of the physical property", as determined by the local tax assessor; (2) adding 2 percent, for depreciation, of the current average cost in Massachusetts of vocational school buildings of comparable size; and (3) adding 10 percent, for depreciation, of the equipment costs of a new school of comparable size. This procedure obviously is largely arbitrary, especially in basing annual charges for building and equipment on replacement costs. Such a procedure implies that the cost of the Worcester program increases whenever qualitative or price changes make new buildings and equipment more expensive; arbitrary procedures of some sort will have to be used, however, until there is a major reform in school accounting techniques. Estimating the cost of tax exemption as the assessed value of the school property times the local tax rate is not only arbitrary but inappropriate unless one is convinced that such a procedure truly measures the costs imposed by the school on other public agencies--police, fire, etc. Despite these methodological objections, it does seem safe to conclude that, vocational education costs about twice as much per pupil per year as regular high school education in Worcester. The higher costs are due largely to lower pupil-teacher ratios in the vocational schools and somewhat higher salary levels.

In continuing the analysis, Corazzini assumes that opportunity costs of regular and vocational high school graduates are the same.

> Given that vocational education is more expensive and that investment in regular high school is profitable, then the choice between the two investments will be a matter of indifference if and only if, the vocational education generates an income stream which lies above that which the regular high school generates, and the present value of the differences in these two streams is just equal to the present value of the differences in the cost of the two programs.[31], p. 51.

This statement is true only if the net present value criterion were used. With the benefit/cost ratio criterion, the two educational investments would only be a matter of indifference when (1) the present value of the differences in the two income streams was just equal to the present value of the difference in costs and when (2) the benefit/cost ratio of regular high school education was 1:1. With a higher initial ratio, equal additions to both benefits and costs will reduce the ratio.*

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* There is a good deal of confusion throughout Corazzini's paper (Reference 31) concerning the distinction between the net present value, rate of return and benefit/cost ratio criteria. At another point (p. 49), Corazzini suggests that costs and benefits of both the regular high school and the vocational high school be thought of as comparisons with the experience of a student who drops out after the eighth grade. In this case, added costs of vocational education and any associated benefits would have a smaller effect on the ratio of benefits to costs because both numerator and denominator would be absolutely larger.

As evidence of the benefits of vocational education 12 local companies, accounting for 23 percent of the manufacturing employment in the Worcester SMSA, were surveyed with respect to starting wage rates for regular high school and vocational high school male graduates. In all 12 cases, the vocational school graduate earned a premium, ranging from 4¢ to 28¢ per hour.* If these wage rate differentials are converted into annual amounts, the number of years over which the differentials would have to be earned for their discounted sum to equal the added costs of four years of vocational education could be calculated; they are listed in Table V-12. Without additional information about the actual earnings of graduates, the analysis could only be pushed further by pure conjecture. Even without this kind of information it is certainly appropriate to point out, as Corazzini does, that

> . . . decision-makers should also be concerned with the opportunity costs to the community which are associated with an investment in high school vocational education. In the case of Worcester a decision to discontinue vocational education for boys could release $300,000 which could be spent on the enrichment of the entire high school system.
>
> Moreover, in 1964 the per pupil current costs at the regular high school were $452. The current costs at the Boys' Vocational School in that same year were $964 per pupil resulting in a difference of $512 per pupil. Thus public authorities could give a local firm up to $512 per year to train a regular high school graduate and still spend only as much as is spent on a vocational school student in one year. This type of on-the-job training might result in greater returns to training that can be gained through vocational school training . . .[31], p. 61

Included in the Worcester study is a survey of the follow-up data gathered by the girls' vocational high school. By 18 months after graduation, about half of the girls were still employed in jobs for which they had been trained although at relatively low wage rates. Without comparative information concerning the employment experience of girls from the regular high school, no further analysis can be made.

A separate analysis was made of the postsecondary programs in Worcester. Foregone earnings were estimated at $2,423 per year for the postsecondary students, which, in addition to school related out-of-pocket costs and public costs, yields an estimate of $3,818 per year as

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* During the period surveyed, June 1964 to June 1965, 71 high school and postsecondary vocational graduates and 23 regular high school graduates were hired by these twelve companies (see p. 96).

Table V-11

TOTAL PUBLIC PER PUPIL COSTS
1963-64

	Regular High School Cost/Pupil Enrolled	Boys' Trade Cost/Pupil	Girls' Trade Cost/Pupil	WITI Cost/Pupil	Practical Nursing Cost/Pupil
Current costs	$452.00	$ 964	$793.00	$1,028*	$457.00
Implicit rent	59.50	165	130.00	165	130.00
Property tax loss	21.00	81	54.50	81	54.50
Totals	$532.50	$1,210	$977.50	$1,274	$641.50

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* This estimate of WITI current costs is a simple average of the $964 figure which applies to WITI students in the Trade courses and the $1,093 estimate which applies to those WITI students in the four technical courses.

Source: Reference 31, p. 38.

Table V-12

NUMBER OF YEARS WAGE DIFFERENTIALS WOULD HAVE TO REMAIN FOR THE PRESENT VALUE OF EXTRA COSTS TO EQUAL THE PRESENT VALUE OF EXTRA RETURNS

Annual Wage Differential	5% Discount Rate	10% Discount Rate
$ 80	Never equated	Never equated
260	17	Never equated
360	11	30
560	6-1/6	10
500	7	12

Source: Reference 31, p. 57.

the total resource cost of this program. Information on initial annual wage rates of graduates in the four technical programs of the two-year program indicates a differential of $400 per year over the vocational high school graduates. For the postsecondary graduates in the 11 trade programs, the average wage differential over the high school graduates with the same vocational training was equal to $160 per year. Corazzini suggests that a differential of $160, if maintained over a working life, would not make the postsecondary education a good investment. The relevant wage comparison, however, is with the regular high school graduate, and there is also about a $400 differential. With a 5 percent discount rate, it would take about 50 years for the present value of $400 per year to equal the total cost over two years and about 22 years to equal total private costs. Information on wage differentials over time would be necessary to make any final analysis.

In a section devoted to an analysis of the Worcester vocational education program from the point of view of dropout prevention, Corazzini compared the experience of students in the vocational program with those in the commercial program. He estimated that 18 percent of the vocational students were prevented from dropping out.

A final section is devoted to an interesting discussion of the relationship between the vocational school and companies in the Worcester area. There is a strong tie; the school considers its responsibility to be training for jobs in the local area, and there is little evidence of geographic mobility among its graduates. There is, however, some evidence of upward social mobility in terms of a comparison between the jobs for which students are training and their fathers' occupations.

Hardly any mention was made of the evening vocational education and MDTA programs in Worcester. A full analysis would have to include the benefits and operating costs of these programs even if no capital costs were allocated to them. If benefits exceed operating costs, this is an important by-product of the regular program.

These three studies are more interesting from a methodological and theoretical point of view than as definitive statements with respect to the relationship between benefits and costs of vocational-technical education. The two case studies are flawed, the Worcester study more seriously, and have no claim to generality. The survey of 100 schools is more comprehensive but contains no cost data and one cannot be very confident that the comparisons between vocational graduates and academic graduates who did not go on to college is really a comparison of similar individuals.

Conclusions

The intricacies of the theoretical literature and complexities of empirical research can be put in perspective. Educational planning is directed toward maximizing broadly defined benefits, subject to a number of constraints. The specification of the constraints is probably more important than precisely defining benefits. The constraints are budgetary, legal, societal, and individual. Money for education is limited and thus the resources that money commands are scarce. Attendance is legally required from six to sixteen, thus imposing a constraining obligation on school systems. Society wants practically all students to graduate from high school and equality of educational opportunity maintained. Individual students want education to meet their own desires and interests, and if it does not they will drop out once legally free to do so. Given the desire to maximize benefits and the reality of these constraints (and probably others), some implications follow for the place of benefit/cost and effectiveness/cost analysis in planning and evaluating vocational-technical education.

1. Analyze Specific Alternatives. The powerful force of constraints makes a determination of the benefit/cost ratio for a program (or rate of return or present value of net benefits) only partially significant because that would only answer the question, "Should the program be continued or discontinued?" The real question is, "Should the resources devoted to this program be diverted instead to a specific alternative?" The federal research effort would be better directed toward analyzing the effects of transferring, say, $100 million from support of vocational education to support of, say, school libraries (or vice versa), rather than attempting to identify the costs and benefits of each separately. Similarly, local case studies should emphasize alternatives like postsecondary technical education compared with subsidized on-the-job training.

2. Consider the Individual First. When local planners introduce a new vocational-technical program, they should be able to show, at least roughly, that the present value of monetary benefits to the enrollee outweigh the monetary costs to him (mainly opportunity costs). Most vocational-technical education is for students legally free to drop out of school. They are in a position to act in their own interests and should not be counseled to enroll in a program unless that benefit/cost condition is met. If societal benefits are significant and individual monetary rewards slight, the payment of stipends to enrollees should be considered.

3. Consider Equality of Educational Opportunity and Minimization of the Dropout Rate as Specific Goals. One vocational-technical education program having a high ratio of benefits to costs should not be established or continued rather than an alternative with a lower ratio if, as a consequence, equality of educational opportunity should be denied a group of students. The school systems do not refuse to educate girls because the benefit/cost ratio is low. Why then should educational resources be allocated so that low benefit/cost ratio programs for boys be eliminated (provided boys want to enroll in the program either because of interest or because they view the ratio of private benefits to costs as sufficiently high)? Selecting programs on the basis of the effect

they have on the dropout rate and on maintenance of equality of educational opportunity calls for effectiveness/cost analysis.

Benefit/cost and effectiveness/cost analyses have the prime virtue of recognizing the constraint on the availability of resources for vocational-technical education. If used within a framework that clearly recognizes other constraints on the educational system, these two methods of analysis can make a significant improvement in the planning and evaluation of vocational-technical education.

Chapter 17

ECONOMIC CONCEPTS AND CRITERIA FOR INVESTMENT IN VOCATIONAL EDUCATION

by

Ernst W. Stromsdorfer

Introduction

Educational investment in human beings represents a major social program in the United States. In 1964-65, the total expenditures for all levels of education in the United States was estimated at $39 billion. About $30.4 billion of that were expenditures on public education. By contrast, gross private domestic investment in 1964 was about $93 billion. Thus, government expenditures for education are about one-third of gross private domestic investment. Actually, investment in education for 1964-65 was even greater than the published figures, since foregone earnings of students are not counted in these data as an educational cost input.

The benefits flowing from these expenditures on education are substantial. Studies based on monetary benefits alone suggest that the average rate of return to education in the United States appears to be as high as the average rate of return to physical capital.[54]

The Relevance of Benefit/Cost Analysis

Even given these high levels of expenditures and demonstrable benefits, it has only been within the last decade or so that education has been widely treated as an aspect of investment in the human being, subject to constraints similar to other types of economic activity. In the past, educators and other policy setters have often argued that every individual in a free society should, in effect, be educated up to the point where the extra utility of an additional amount of education becomes zero.

"Every student who has the interests and abilities [should] be encouraged to get as much education as possible." [12] p. 30.

Yet an attempt to attain such a goal as it is so absolutely stated could mean, at the limit, the devotion of the entire gross national product to education. No individual, educator, or society can or will act in this way. The objectives of education are relative, and resources to achieve these are limited. However, economists can accept the above goal of educators even as it is stated and, ideally, with the appropriate techniques, help indicate how for a given amount of resources this goal can be approached as closely as possible.

However, benefit/cost or effectiveness/cost analysis is likely to impose constraints on the proponents of vocational and technical education at the same time that it helps optimize the fulfillment of those objectives. Rigorous economic analysis forces the proponents of a social program to quantify as closely as possible the costs and benefits, both monetary and nonmonetary, of a given program rather than rely on subjective assertions for program support, however strongly various elements ~~of~~ society may agree with these assertions. It causes questions to be asked and routes of investigation to be pursued that otherwise might not be asked or pursued. And where monetary benefits do not equal monetary costs, society or individuals must then explicitly decide whether nonmonetary benefits adequately compensate for this monetary discrepancy. Whatever decision is ultimately made, the choice among alternatives is at least (ideally) made on the basis of the most complete and accurate information possible.[55-60]

Basic Problems of Benefit/Cost Analysis

Measurement of Benefits

A benefit can be defined as any result of a social program that expands total individual or social welfare in net terms. This can occur either by increasing economic or noneconomic welfare. With respect to economic welfare, benefits occur either directly by increasing productivity or indirectly by freeing some resource for use in other areas. Fortunately for the application of benefit/cost analysis to vocational education, the major social emphasis on objectives seems at least at the federal level, to be on the technical efficiency aspect of increasing human productivity and thus, many of the benefits of vocational education can be measured or approximated in monetary terms.[61,62]

However, much of the difficulty in applying benefit/cost techniques in the area of education and other social programs is due to the intrusion of nonmonetary or otherwise unmeasurable costs and benefits into projects that are multidimensional in their impact on human welfare. This becomes apparent in any attempt to evaluate vocational education. The objectives of vocational education and the benefits flowing from their achievement are many faceted. Economic efficiency; equity or income redistribution; socialization, the imparting of civilized values and patterns of behavior; and consumption of education for its own sake are all objectives of education. Each imparts a benefit peculiar to itself.

With respect to economic efficiency, the following results:

1. Higher wage rates.
2. Increased productivity of associate workers.
3. Higher profits.
4. A greater rate of economic growth, which will be reflected in 1, 2, and 3 above.

5. A smoother adjustment to economic change, which will be reflected in 1, 2, 3, and 4 above.

6. A lower level of frictional unemployment, which is part of 5 above.

With respect to equity or income redistribution, we achieve:

1. A distribution of wealth more in tune with social values.

2. Increased economic efficiency to the extent that before the income redistribution, investment in education was reduced by lack of funds or lack of access to the borrowing of funds.

3. The reduction of future economic dependency.

With respect to socialization, we achieve:

1. A stable environment in which economic and social change and development can occur.

2. The preservation of values and traditions that maintain the social fabric.

3. Greater economic efficiency.

4. Reduction in social costs associated with the reduction of antisocial behavior.

With respect to the consumption objective, we achieve:

1. Leisure.

2. A broader awareness and appreciation of our environment.

3. Improved efficiency when work is resumed.

This list of benefits indicates that the above objectives are highly complementary. Therefore, care must be taken not to double count. For example, a higher growth rate will be reflected by higher average wage rates. To some extent one can claim as benefits one or the other (higher wage rates or higher growth rates) but not both. Also, these objectives are competitive on other levels. The pursuit of leisure through the consumption of education may lead to a disdain for menial but socially useful labor.

To the extent that the equity, socialization, and consumption objectives are complementary to that of economic efficiency, their benefits are in part measurable in monetary terms. To the extent that they are competitive, measured benefits, whether monetary or nonmonetary, will be reduced.

A major reason why the estimation of benefits is more difficult than the estimation of costs is because it is difficult to ascertain what benefits would have accrued to a given vocational graduate or a cohort of a vocational graduate had either pursued some other course of action.[63] Clearly, one cannot compare the vocational graduate's labor market experience after graduation with his labor market experience before or during his secondary education. The periods are essentially noncomparable due to legal, institutional, and human physiological constraints surrounding the nature and amount of labor force participation. Yet, for the most common follow-up studies of vocational graduates, such comparisons are implicitly made. In these studies, considerable emphasis is placed on placement ratios with no knowledge or consideration of what might have occurred in the absence of vocational training. In benefit/cost terms, such studies are meaningless since the placement ratios are in gross terms and no consideration is given to costs. Operationally, economic benefits before graduation are very low and often zero; after graduation they are positive. In these follow-up studies, placement is implicitly attributed to graduation with a skill, an overstatement and a serious error. Obviously, if the person had only graduated from grade school, and had not taken vocational education but had entered the labor market, he would have taken up some occupation and earned some positive economic benefit.* Figure V-3 indicates the comparative economic benefit profile of a "representative" person had he been a grade school graduate as contrasted with his experience had he been a vocational graduate. Oace is the benefit profile of grade school graduation, and Oabcd is the benefit profile of vocational graduation. If other things are equal, the incremental differences between these two curves over time measure the marginal or differential costs and benefits accruing to vocational graduation compared with grade school graduation. Ideally, this is the type of data we need for a conceptually sound evaluation.

Since a person either pursues one course of action or another and the course of action taken is irrevocable given the context of time, observations like that described in Figure V-3 are impossible to obtain. It then is necessary to devise a control group to serve as a proxy for the alternative experience the person's own experience can never provide. But the use of a control group is not the conceptual equivalent of the above situation for two reasons. First, the study group and the control group will usually have a different mix of sociodemographic characteristics as well as different motivations, values, and other characteristics that affect labor market experience. While statistical techniques can help

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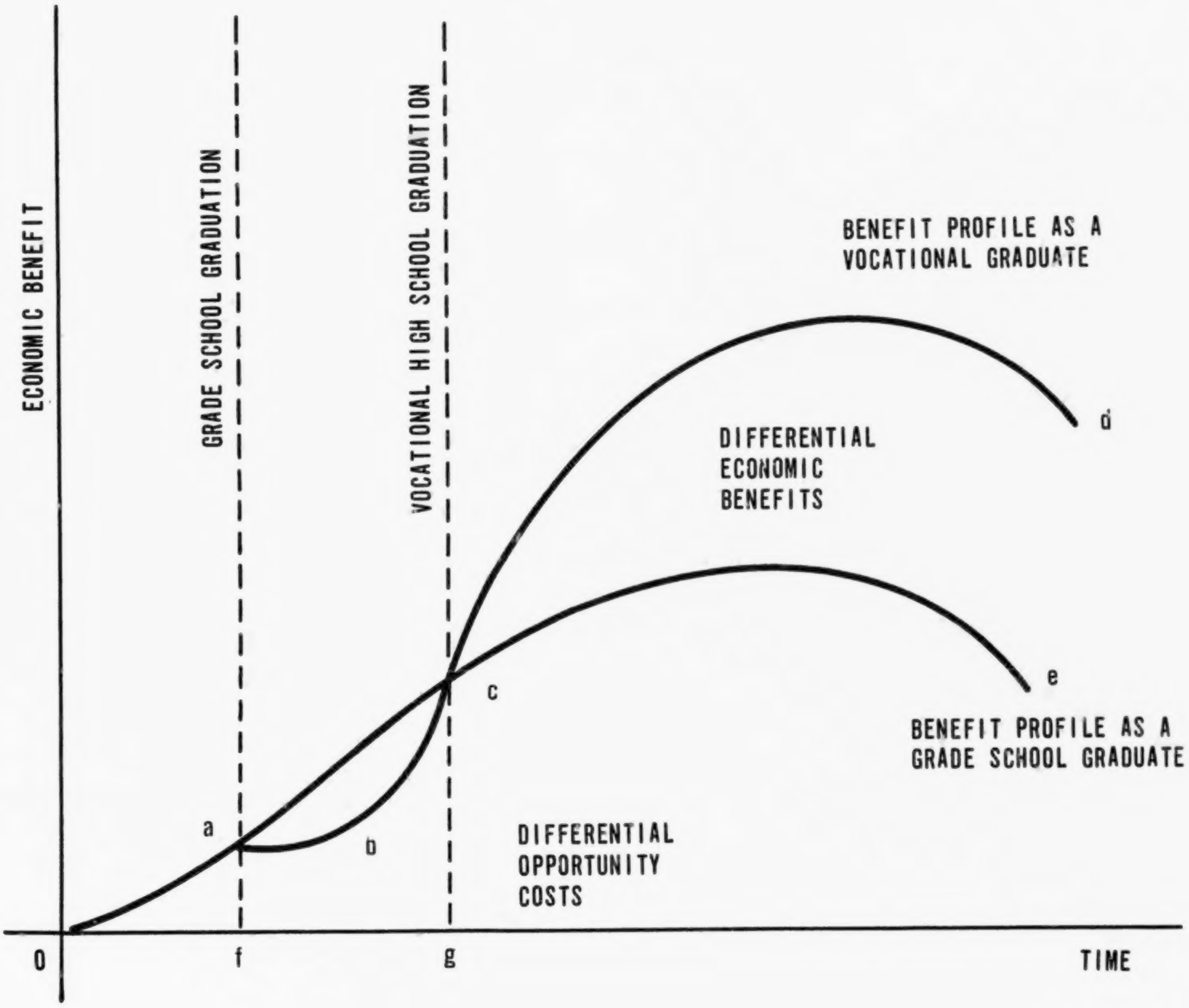
* This is not to argue that the placement ratio is not a valid measure of the efficiency objective. Effectiveness/cost techniques can accept as given a stated net placement ratio and then indicate the most efficient or optimal use of resources to achieve this goal.

FIGURE V-3

ECONOMIC BENEFIT PROFILE OF A PERSON AS A GRADE SCHOOL GRADUATE COMPARED WITH HIS ECONOMIC BENEFIT PROFILE AS A VOCATIONAL GRADUATE


ECONOMIC BENEFIT
GRADE SCHOOL GRADUATION
VOCATIONAL HIGH SCHOOL GRADUATION
BENEFIT PROFILE AS A VOCATIONAL GRADUATE
d
DIFFERENTIAL ECONOMIC BENEFITS
c
e
BENEFIT PROFILE AS A GRADE SCHOOL GRADUATE
a
b
DIFFERENTIAL OPPORTUNITY COSTS
0
f
g
TIME

control the influence of these different characteristics, different patterns of interactions between variables within the two groups can never be completely controlled.* Second, the experiences of the two groups may not be truly independent. For instance, if we are using grade school graduates as a control, given a high level of unemployment, the graduates of secondary vocational education may effectively exclude equally skilled but "less educated" workers from access to the jobs currently in short supply. Such a situation would clearly overstate the benefits to vocational education. The problem reduces itself to an attempt to determine what would have occurred in the absence of vocational training or retraining of the unemployed. This is not an easy task, since the vocational training or retraining has occurred and interactions and interdependencies between persons in the labor market exist and are difficult to sort out.

Given all this, at least three types of control groups appear useful. First, one comparison would be to contrast the grade school graduate and vocational high school graduate as in Figure V-3. Second, comparisons can be made between vocational graduates and high school graduates who have had no formal vocational training. Taking the difference in costs and benefits between vocational and nonvocational graduates should provide some evidence of the extra gain or loss to the vocational group in question. Third, comparison of these two groups against a group that has minimal or no formal schooling should provide some estimate of the rates of return to both vocational and nonvocational high school graduates.

In each of these comparisons, the relevant socioeconomic variables should be controlled, including any additional postgraduation training. Which of the three comparisons one should make depends on the purpose of the analysis in question and the availability of data.

The Vocational Graduate and the Dropout

The problem of a proper control group leads to another difficult problem, that of measuring external economic and external noneconomic benefits to vocational education. In the literature, benefit/cost comparisons are usually made between the vocational secondary graduate and the academic graduate. Since the ratio of differential monetary benefits to monetary costs appears to be greater for the academic graduate than for the vocational graduate, it is often asserted as a justification for vocational education that additional social and private nonmonetary benefits accrue to the vocational graduate compared with the academic control group. The reasoning here is that many vocational graduates, had they been forced into an academic curriculum, would have likely dropped out of high school, and consequently a variety of social and private disabilities would have occurred.

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* Control of at least the following sociodemographic and socioeconomic effects seems necessary: sex, race, age, IQ, socioeconomic status, and occupational and industrial attachment. Thus far no benefit/cost study of vocational education has effectively done this and no data are being collected on a national or state basis that will facilitate such analysis. Several case studies exist or are in process, however, that incorporate such controls in part. See References 31, 51, 64.

If this hypothesis is a true statement, care must be taken to avoid double counting these external economic and noneconomic benefits. In this particular area of benefit/cost analysis, double counting is particularly likely to occur. Such factors as increased labor force discipline; increased occupational, georgraphic, or industrial mobility; decreased unemployment; and other factors associated with performance of the individual in the labor market will already be partly if not largely accounted for in the earnings benefits accruing to the vocational graduate. However, it is true that interactions occur between persons in the economy such that the increased efficiency of worker A will tend to increase the efficiency of workers B, C, D and so on who associate with him. And profits will also increase. In this case, additional benefits do occur that should enter into the estimate. Even if they are not estimated quantitatively, the enumeration of such benefits will serve to establish overall dimensions and properly circumscribe the analysis. If the vocational program is instrumental in salvaging persons who would have otherwise become social liabilities, benefits not measured by wages to the graduates accrue from the release of resources from police protection, the payment of social workers, public health workers, and so forth. The proper technique in this case is to compare the differential benefits between the vocational graduate and the academic dropout, since the assertion is that the vocational graduate was a potential dropout from the academic curriculum.

However, this comparison is not exactly correct. What is really needed is to know how many potential academic dropouts switch to the vocational curriculum, and, having switched, how many graduate. This information is not directly available.

Thus, the benefits measured from the above comparison will be gross and constitute an overestimate. One should not assume that all academic dropouts, had they prior knowledge that they were going to drop out, would have switched to the vocational curriculum.

Second, not all those potential academic dropouts who switch to the vocational curriculum will graduate. Some will drop out here, too. Therefore, the gross benefits above must be weighted by the joint probability of a person switching to the vocational curriculum and, then, having switched, graduating. Clearly, this probability will be less than unity.

Transfer Payments

In making this comparison, note that increased benefits do not accrue to society because unemployment compensation or relief payments become less. These are transfer payments coming from previously produced and counted income and as such represent no net change in total social wealth, but simply a redistribution of wealth among members of society. Reduction in taxes used to finance such transfers should also be created from a social point of view. From a governmental unit point of view, one might want to treat changes in these various taxes or transfers as "benefits" to the particular government unit, but one must be constantly aware of the special nature of these benefits. Also, it is incorrect to argue that increased tax revenues flowing from the increased earnings of vocationally trained workers "repay" society for its investment in the education of the workers. Society is already repaid by the higher earnings. Certainly, the governmental unit is repaid, but it could get "repaid" even more efficaciously by simply raising the tax rate. From the private point of view, an individual would properly treat such changes in taxes or transfers as net additions to or subtractions from his total welfare. All this is simply to stress that there are differences in perception of benefits and costs between individuals, society, and governmental units.

Financial Option Return

Finally, one area of secondary benefit where it appears that the vocational graduate may be at a distinct disadvantage compared with the academic graduate is in the area of the financial option return, the ability to gain additional education and the benefits therefrom as a result of successfully achieving a given level of education.[65] Since the curriculum of the vocational graduate is qualitatively different from that of the college preparatory graduate, he may find it more difficult to gain entry into college, or, if he does gain entry, it may be to an institution of lower quality or his probability of successful graduation may be lower. In each case, his financial option return is likely to be lower than that of the academic graduate. This institutional phenomenon implies a reduced economic flexibility both for the individual and society and a consequent potential diminution of benefits to both.

Structural and Cyclical Unemployment

Unemployment is another complicating factor in the measurement of the benefits of vocational education. In situations where unemployment is structural rather than cyclical, vocational education may facilitate labor force transformation and, in social terms as well as private terms, yield a high stream of benefits.[52,66-69] However, to the extent that cyclical rather than structural unemployment occurs, it is likely that much of what may appear to be re-employment benefits is simply the displacement by retained workers of other less preferred workers. There is a shift in the incidence of unemployment but no net reduction. The experience of the retrained worker is not independent of that of the other untrained workers in the labor market who are seeking employment. Since there is no theoretical technique in economic analysis that allows one to distinguish between structural and cyclical unemployment, the measurement of benefits of vocational education designed to alleviate unemployment is risky business at best.*

Thus, it is theoretically more sound to measure the economic benefits to vocational education in a context of full employment, however full employment is defined. Under these conditions, while a reallocation of labor occurs as successive incremental units of trained labor enter the labor market, the net effect is to increase productivity and output. The reallocation of labor may cause a redistribution of income between the members of society. Whether the increase in economic efficiency implies an increase in total welfare as well as total output depends on the assumptions one makes concerning the preferability of the prior income distribution compared with the income distribution existing after a given influx of newly trained workers into the labor force.† There are no simple economic welfare criteria for making this judgment.

Vocational Education as a Subsidy

This discussion of the external effects of income redistribution leads to two other aspects of the measurement of the costs and benefits of vocational education. The first entails a consideration of the implicit subsidy of economically inefficient firms. The second entails the use of vocational schools and pools of vocationally trained workers as an inducement to industrial relocation.

Skill Shortage

The usual method of establishing a course of study in an area for a given vocational skill is the detection of a shortage of trained workers.‡ This appeal to the existence of a shortage is often made by a given firm or industry. If this shortage of workers at the wage rate offered represents not a structural bottleneck but rather the fact that the firm is offering a wage rate below the going market rate for that skill, then the firm is really requesting that the community or society train enough workers of that skill so that the supply of workers increases to the point where the new labor supply curve intersects the demand curve at the wage rate the firm is economically able to pay. This eliminates the shortage. However, a more socially desirable way for the shortage to be eliminated might be to offer wage rates equal to the market rate for that skill. If the firm would be forced out of business due to this action, there is reason to suspect that society perceives a more efficient alternative use for the resources tied up in that firm. It is important to note that while the individual workers may receive a positive gross gain from this training, a higher net return could have been gained for them and for society by applying the resources elsewhere, since the firm or industry was already a high cost, inefficient operation.

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* The problem is further complicated by the fact that cyclical and structural unemployment interact on each other in as yet undetermined ways, making it even more difficult to determine when unemployment is structural and when cyclical.

† See Reference 57, p. 440 ff., for a discussion of the welfare criteria involved in assessing the desirability of a given economic change.

‡ One useful definition of a shortage is given by the situation wherein "the number of workers available (the supply) increases less rapidly than the number demanded at the salaries paid in the recent past." See Reference 70.

Again, the closure of an uneconomic firm or industry may result in shifts in income distribution. The choice of which action to pursue, depends in part on the income distribution preferred by the community or society. In any event, it seems clear that the practice of training large numbers of workers in skills that seem to be in chronic shortage has occured and continues to occur in the training in such low wage, low prestige skills as nurse aides and waitresses. Especially with nurse aides, it appears that a variety of institutional constraints exist to keep wages low, thus resulting in high turnover. Society, requesting these services at low rates, finds itself in a position of having to subsidize investment in this skill to assure a given supply of nurse aides given the high attrition rate due to low wages. Here the expenditure is essentially a subsidy to the health industry, enabling it to charge lower rates to customers by keeping costs lower with an assured labor supply at the lower wage rates. The benefits of this retraining are in the form of lower medical rates, and are at least partially cancelled by the training subsidy. There is no necessary social gain from this tactic other than the satisfaction society achieves from being able to choose a social policy route more pleasing to its social welfare function. Again, both the training costs and the workers necessary to maintain a given flow to the occupation in the presence of below equilibrium wage rates could have been better used elsewhere.

Location Incentive

A common benefit attributed to the presence of a vocational school is that it provides a locational incentive for firms. Several aspects to this problem exist. First, if all areas have vocational schools, the net locational effect from such schools will be small or zero. Second, the locational effect of a school is only one of several locational effects so that net benefits should be weighted by the probability of firm location, given the presence of a vocational school, holding all other marginal location effects constant. This will give an estimate of net potential benefits. Third, problems exist similar to the cyclical unemployment problem discussed above. Given full employment, location of a firm in a given area as a result of the normal process of economic expansion results in an increase in output for society, although income redistribution effects again occur between groups and regions. As above, some account should be taken of the external effects of this income distribution in making assessments concerning the impact of this action on total social welfare.

However, to the extent that the individual community has trained workers in skills highly specific to that firm, the firm has been subsidized by the community.* The community should treat this subsidy as a cost to itself and balance this against the benefits of the extra earnings flowing from having that particular firm in the area. If the skills are specific to that particular firm, and the firm decides to move and leave the community and its workers stranded, community welfare will be reduced, since the stranded workers will have been trained in skills that are irrelevant to all other firms where they might seek new employment.

Given the presence of cyclical unemployment in the economy, the tactic of inducing industry to locate in an area with the promise of a community subsidy in the form of a work force trained in specific skills can only redistribute unemployment as well as incur the loss entailed in the stranding of a labor supply in the region the firm vacated. The workers of this region cannot employ their specific skills elsewhere. The amount invested in training by the receiving community represents a net loss of benefit to society as a whole. Finally, even where the skills in both communities are specific to the worker and not to the firm and hence can be marketed to other firms and industries, there is no net increase in welfare to society. There will be a simple redistribution of the losses of unemployment between the two communities, with total unemployment and output remaining the same for society. In addition, investment resources will likely have been badly allocated, and this will result in a decrease in social welfare.

In sum, care should be taken in attributing industrial development benefits to the mere fact of the establishment of a vocational school in a region or city. First, the net extent to which such an action is perceived as a location incentive by firms is not clear. This assertion of a locational effect still lies in the realm of a poorly tested hypothesis. Second, even if such a location incentive exists, care should be taken in the identification of benefits. Under the most unfavorable assumptions, a net loss could occur to society even though a given community achieved a gain.

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* See Reference 71 for a discussion of the differences between specific and general training. General training is that skill acquisition that raises one's productivity equally in all companies. Specific training raises productivity in a given company to which the training is specific, but in no other company should the worker transfer.

Costs

The treatment of costs in the context of vocational education and other types of social programs requires a generalized concept of costs.[72] All costs should be viewed as opportunity costs. The costs of training students in a given skill are the foregone opportunities resulting from the fact that resources used in this training effort cannot be used elsewhere.

The following types of costs should be considered:

1. Current costs, which include such variable costs as those of teachers salaries, heat, and light, as well as costs from nonschool system support.

2. Capital costs for both physical plant and instructional equipment.

3. Cost correction factors to adjust for the fact that nontaxed public resources will buy more goods and services in the marketplace than taxed private resources.[73]

    a. A sales tax correction factor to be applied to current cost items bought in the marketplace.

    b. A property tax loss correction factor to be applied to the assessed valuation of school property.

4. Foregone earnings of students.

Measuring opportunity costs for students still in secondary schools requires an awareness of institutional constraints such as child labor laws. From the private standpoint, to the extent that an individual is prohibited from working and forced to attend school up to a certain age, he perceives no real costs for he has no alternative but to go to school. Nor do his parents have any alternative but to send him to school, thus, he cannot be employed in nonmarket or home production during those hours he is in school. However, society does experience costs since, the legal prohibition on work notwithstanding, children are productive and society has the alternative of rewriting the laws and letting them work. Society foregoes this output and, thus, imposes a cost on itself. For these early teenage years, there is a real problem in measuring this opportunity cost, since the usual technique is to identify as a foregone opportunity those returns that can be earned in the next best employment. However, there are few wage observations in the marketplace for younger teenage workers on which to base a judgment as to what is the proper measure of opportunity costs. Also, the wages perceived will overestimate true opportunity costs since, if a substantial number of children moved into the labor market, the supply of labor would increase and lower real wages for this age group.

Finally, the problem of measuring opportunity costs is further complicated by the occurrence of teenage unemployment. Some argue that opportunity cost estimates should be adjusted downward to reflect unemployment. Concurring with Mary Jean Bowman[72, p. 431] I would argue that what is being measured is the commitment of resources to an activity that precludes their commitment elsewhere. We are not measuring our failure to use these resources. If in some sense one attempts to measure what is put into education rather than what is foregone, one has serious difficulties in making comparisons between the educational investment input in such periods as, say, the early 1930s as, opposed to, say, the late 1960s. The latter period approaches "full" employment so that using a "what is put in" cost concept approaches a pure opportunity cost concept. However, for the former period, there is a wide divergence between what is put in and a true opportunity cost in the sense of what could have been produced.

Uncertainty and Risk

The major sources of risk and uncertainty in measuring the benefits and costs to society are the risk of mortality and the lack of knowledge concerning the true time stream of benefits flowing from a given investment in vocational education. The former problem can be taken care of easily from society's standpoint by applying age-sex-race specific mortality estimates to the time stream of benefits and costs. Adjustment for the second problem is more difficult, and the practical problem is increased since one cannot wait one or more generations before making a judgment on the fruitfulness of a given social investment. Estimates of the time stream of benefits are usually based on a few months' or a few years' observation at most.* These differentials are usually assumed to be constant over the benefit estimation period; however, this is obviously a tenuous assumption.

From the private standpoint, any number of factors may intervene to either reduce or increase the individual's net benefit stream. One recourse to the individual for dealing with the problem of unemployment is to assume that he will be fully employed, given society's commitment to this goal. From society's standpoint, a useful strategy would be to assume different levels of full employment, say 3, 4, and 5 percent. From both the individual and social standpoint, a similar strategy would be to employ wage rate differentials in measuring benefits and costs rather than earnings differentials.[74] The argument here is that wage rates are a better measure of productivity than earnings and that unemployment, in general, should not be blamed on differential levels of education.

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* For example, Cain and Stromsdorfer[67], had a maximum of 24 months and a minimum of 18 months over which to project lifetime benefits of government retaining. Arthur Corazzini[31] implicitly projected starting wage differentials among vocational, academic, and technical graduates up to 18 years. Both recognize the dangers of such a practice. Kaufman et al.[64] will have a six-year earnings experience for a cohort of academic and nonacademic high school graduates. Projections will be made from this base.

Another common problem facing both society and the individual is the possibility that the economic value of a given skill may be partially or wholly destroyed by economic change. One basic adjustment for this uncertainty is simply to be very conservative in the estimation of costs and benefits. Another adjustment is to use much higher rates of discount to help account for uncertainty and for risk. This amounts to shortening the benefit stream. Next, if the variances in one's data are known, one can easily get some estimate of the "best" and "worst" outcomes by using the variances to establish upper and lower bounds to one's estimates. Finally, one can systematically vary the different parameters of a given model to determine how sensitive the outcomes are to these changes. Policy-makers may resent being confronted with a variety of possible outcomes, however, so that the exercise of informed judgment is still necessary in choosing the one or two most likely outcomes.

Investment Decision Rules and the Choice of Discount Rates

Two decision rules are relevant in making choices between alternative investments in vocational or other types of education. The present value rule specifies that one should invest in a given activity if the sum of discounted benefits less discounted costs is equal to or greater than zero. The internal rate of return rule specifies that a given activity should be carried out when the rate of discount that makes the discounted benefits minus discounted costs equal to zero is equal to or greater than some specified rate. For both rules, the discount rate or internal rate of return representing the cut-off point for further investment must be specified by the analyst.

Discounting is justified and necessary because people have a positive time preference for present over future goods and because a given stock of resources can be used either to generate increased future wealth or to increase present consumption.* The discount rate reflects the opportunity cost of using a given resource in one alternative rather than another. Therefore, one should use the discount rate that reflects the social opportunity cost of capital.

The problem now becomes "what interest rate should one use?" The notion of a unique interest rate is theoretical. Many interest rates exist in the marketplace, and a variety have been used in benefit/cost analysis. At one extreme, the U.S. Army Corps of Engineers has used discount rates as low as 3-1/8 percent in its benefit/cost analysis.[75] At the other extreme, some analysts have discounted at rates as high as 15 percent.[66] Gary Becker and others argue that a rate of 9 to 10 percent reflects the social opportunity cost of capital. Otto Eckstein and John Krutilla estimate a social opportunity cost of capital of about 5 to 6 percent.[76]

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* See Reference 58, pp. 115-23, for an extensive discussion of the practical and theoretical justifications for and problems in discounting.

If too low a discount rate is used relative to the true social rate, there will be a tendency to invest in training skills and programs that yield a smaller increment to individual and social welfare than otherwise might have been gained. The argument is that some estimate of the social discount rate is most relevant and that the market rate more closely approximates this rate. However, an interesting problem develops in the context of this discussion of investment in vocational education. The market rate of return depends on, among other things, the given income distribution. Presumably one of the major goals of expenditures on education in our society is to change the distribution of income in our society. Thus, such investment may likely change the social rate of discount over time. No conceptual problem arises from this situation in the use of our present value rule for we can tag the changing discount rate with time subscripts and automatically adjust our discounting process. However, if the social rate of discount changes over time, the use of a computed unique internal rate of return becomes conceptually incorrect.

Also, the appeal of the market rate of interest from a normative point of view is weakened by the presence of a whole structure of interest rates and risk factors along with a variety of imperfections in the capital markets. In addition, the federal government has a positive interest rate policy and manipulates the market rate.

Finally, while the choice of an appropriate social discount rate becomes at least in part a value judgment, if a project is to be pursued in the public sector on other than economic grounds, this action should be decided by votes and not by adjusting the rate of discount downward until the project becomes economically "efficient."*

What private rate of interest should the individual use to discount the future stream of benefits flowing from such investment? The most common prescription is that the private rate of discount should be the lending rate of interest if savings are expended to accomplish this investment. This rate will vary, depending on whether a person is a risk-seeker or a risk-avoider. If he is a risk-avoider, he may choose to invest in those activities that have a low risk of default or failure. The lending rate may be as low as 4 to 5 percent. If he is a risk-seeker, the private rate may be much higher, perhaps reflecting the average rate of return one can earn on some representative portfolio of common stocks.

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* Arnold Kotz is responsible for this point of argument

If the person is borrowing funds to finance investment in himself, the private rate of discount should be the borrowing rate of interest. As will be noted below, this lack of a unique rate will cause difficulties in deciding between alternative investments when the present value rule is used.

Present Value versus Internal Rate of Return

Much controversy exists over what constitutes the proper investment criterion. Many writers argue that the present value rule is most correct, since it automatically assures that the present value of benefits is at a maximum. However, both present value and internal rate of return will result in the proper and identical investment decision given that: capital markets are perfectly competitive, investment alternatives are not interdependent, all relevant investment choices are completely divisible so that marginal adjustments can be made, and all net returns are reinvested at the original rate of return or higher up to the end of the project with the longest benefit stream. In this context, both are correct and neither is to be preferred over the other.

However, the real world imposes constraints such that each of these rules can, at times, give advice that will result in the investor not maximizing present value of benefits. These constraints will be considered in turn. (see Table V-13)

Constraints that Invalidate the Rate of Return Criterion

Interdependency. Where two projects are mutually exclusive, the use of the rate of return criterion breaks down. It is possible under these conditions to invest in an activity that has a higher internal rate of return but lower present value than a different project. This criticism is very relevant from the view of an individual contemplating an investment in himself. When an individual makes a decision that commits him to some irrevocable course of action for some time period, he eliminates all other actions he may have taken at that point and for the period to which he is subsequently committed. If he decides to take training as a carpenter, he usually cannot simultaneously decide to take training as a psychiatrist. In the future he may do so if he has the necessary remaining life span and other economic and personal flexibility. Thus, occupational investments in human beings have the general characteristic of being mutually exclusive.*

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* The problem may be clearer if we think of the human being as being a unique site or locus on which only one type of training can occur at a given point in time.

Table V-13

CONSTRAINTS ON DECISION RULES

Difficulties Occur With Present Value When:	Difficulties Occur With Internal Rate of Return When:
Different discount rates are used to evaluate a set of projects with dissimilar time-benefit streams.	Projects are mutually exclusive.
Result: Different rankings can occur for each discount rate.	Result: A high rate of return project may be adopted which precludes the possibility of maximizing net present value.
Discontinuities occur such that project costs become large relative to current resources.	The market interest rate varies over the life of the project.
Result: Adoption of a given project on the basis of its higher present value may preclude the adoption of two or more smaller projects whose present value is larger than the original project.	Result: The single computed rate of return becomes conceptually irrelevant since all time periods are treated on a par. This is the most fundamental conceptual failure of the rate of return rule.
Budget constraints occur.	Benefit increments from the original investment are not immediately reinvested at the original rate of return or higher.
Result: This is a variant of the discontinuities constraint and, again, the likelihood is that failure to maximize present value will occur.	Result: Maximization of net present value will not occur.
	More than one cost outlay occurs over time.
	Result: a) Multiple rates of return are computed no one of which is conceptually correct; b) Problems of mathematical estimation become extremely difficult.

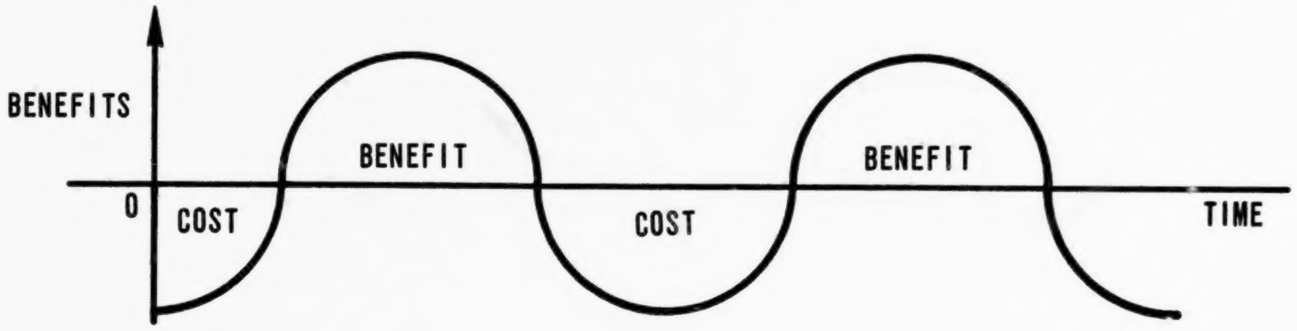
From a social point of view, this criticism of the internal rate of return rule is not so serious since investments from the social standpoint are less likely to be interdependent. Thus, if the construction of a comprehensive high school at one end of town proves to be an economic mistake, one can always construct an area vocational-technical school on a different site in another part of town. Or, an incorrect investment in individual or group A does not preclude a correct investment decision to be made with respect to individual or group B.

Successive Cost Outlays. More than one cost outlay occurring over time will result in more than one rate of return being estimated for the same benefit/cost stream. The same number of rates will exist as there are inflection points where the cost stream switches to a benefit stream and vice versa.

From the private standpoint, this is a possibility due to the risk of unemployment. The individual can perceive at least part of the expenditure necessary to maintain him during periods of unemployment as costs incurred to maintain his productive capacity in a given skill. Thus, he may have a time stream of benefits and costs as appears in Figure V-4 below. Here, four internal rates of return would exist, but none of these is necessarily correct.

FIGURE V-4

TIME INCOME STREAM OF AN INDIVIDUAL WITH MULTIPLE COST OUTLAYS



The unemployment example is somewhat more complicated from the standpoint of society. One could argue that in any case society is committed to keeping its members alive, at least a certain number of them, to assure its own continuity. Again, only those differential costs that are uniquely associated with maintaining a given skill level should be counted as necessary costs to assure the viability of the original skill level.

Finally, from both the society and private viewpoint, if the person had to reinvest in himself due to the fact that technological change had destroyed his previous skill, this new investment cost and the benefits flowing from it should be treated as an entirely new time-income sequence. Multiple rates would not be a problem here.

Changing Rate of Discount. As indicated earlier, successive investment in vocational education over time will likely change the distribution of income and hence, change the social rate of discount, which depends, in part, on the distribution of income. In this case, a uniquely calculated rate of return becomes irrelevant since it does not reflect the changing social opportunity cost of capital.

Constraints That Invalidate the Present Value Criterion

Multiple Discount Rates. As indicated earlier, an individual may invest in himself using both savings and borrowed funds. A different discount rate may be relevant to each of these sources of funds. Assuming he did not use some weighted rate of discount but chose to discount the stream of costs and benefits from different alternatives by each rate, the ranking of alternatives at one rate may differ from the ranking of alternatives at the other. It is then unclear as to which relative ranking is the correct one.

Also, advice is often given that when a unique rate cannot be chosen, more than one social rate of discount should be used to provide a range of estimates of discounted costs and benefits. This again may result in differential rankings of alternatives, with resulting indeterminacy.

Budget Constraint. The present value rule will prove to be invalid when a budget constraint or investment discontinuities face the decision-maker. If one follows advice to invest in that activity that has the highest present value, it may well be that some alternative combination of investments will prove possible, each of which require smaller investment outlays and yield a summed present value greater than the single larger investment. For example, given a constraint of $1,000 on the amount that can be invested, investment A, requiring a $900 outlay may yield a present value of $1,100 while the set of investments B and C requiring outlays of $400 and $600, respectively, yield present values of $600 and $800, respectively. Present value is highest for A and it should be chosen over B or C if one is to follow the rule stated above. But, due to the budget constraint, choosing A precludes investing in B or C, each of which have higher internal rates of return than A. Thus, the proper strategy when budget constraints or discontinuities occur, as long as the alternatives are not mutually exclusive, is to choose the set of alternatives with the highest internal rates of return. This will actually maximize present value for the set of investments.* In this case, invest in B and C to gain a total present value of $1,400 as contrasted with only $1,100 for A.

Such a constraint is a real problem from the standpoint of the individual seeking to invest in himself. As investors, students have limited access to investment sources. Also, they are relatively unproven in the labor market so that there is a great deal of uncertainty concerning the benefit stream of an investment in them. Capital markets are relatively imperfect in the area of human resource investment due at least in part to the unwillingness of creditors to accept using oneself as loan collateral. Thus, high risk and liquidity premiums would have to be charged if the capital market were to make funds generally available to investors in this area.[71, p.55] Institutional constraints are such that the rates are not charged and the investment funds are not generally available to finance one's self-investment at the secondary education level. Thus, the individual is generally faced with investment budget constraints that do not allow him perfect choice among all possible investment alternatives. He may have sufficient funds to contemplate training as a carpenter but not as an electronics technician or as a physician.

Investment budgets are also constrained from a governmental standpoint. Legislative limits are set on amounts to be spent by school districts and other governmental units, and while these constraints are usually specified for limited periods, they do tend to be repeated indefinitely.

Only in the broadest sense does a constraint exist for society, since it is difficult to conceive of a given investment in this area of education that would be so large as to absorb a significant proportion of the gross national product.

Successive Cost Outlays. When successive cost outlays occur for given sets of investment alternatives, the use of different discount rates may result in different rankings of investment choice between the investment alternatives. That is, for discount rate a, alternative X may be preferred to Y, which in turn may be preferred to Z. But for discount rate b, Z may be preferred to X, which in turn may be preferred to Y.

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* The author is indebted to Professor Bruce Davie for this point of clarification.

Conclusion

My remarks concerning the efficacy of economic analysis have been very positive. However, in concluding, some broad limitations of benefit/cost analysis should be stated. In addition to a variety of conceptual and practical problems of measurement of both cost and benefits, benefit/cost analysis will be more difficult to apply where:[55], p. 731

1. The inception and operation of a social program (e.g., "free" undergraduate college education for all members of society) is so large as to alter the entire constellation of relative prices and outputs in a nation. This is more of a problem ex ante than ex post. Ex post, relative prices and distribution of output will reflect all the interaction effects of the non-marginal change.

2. Both benefits and cost are widely diffused, with large amounts of income redistribution between programs occurring across disparate sectors of the society and where large proportions of these benefits and costs are of a nonmonetary nature.

3. A social program is being compared against an investment alternative in the marketplace, e.g., increased investment to publically supported hydroelectric power systems versus increased investment in private hydroelectric power systems. Here, a major nonmonetary element is the interjection of increased government activity in the marketplace.[56]

4. Different social programs having different outputs are being compared, e.g., increased investment in vocational education versus increased investment in air pollution control.

5. Within the same broad social program, comparisons are made between different parts of the social program, say, vocational education benefits versus benefits of academic secondary education rather than making comparisons between different approaches to optimize the benefits to a given program, say television instruction versus teaching machine instruction within a given vocational curriculum.

I would not agree that benefit/cost analysis is likely to be less efficacious in the area of social programs that directly impact on the human agent, such as education or health, than it is in such social programs as transportation or multiple purpose river development. Not because I think the problems are just as straightforward in the former, but because the problems of the latter seem equally obtuse.

Discussion:

Dr. Spiegelman:

Essentially, I would contend that we have been overconcerned about objectives and goals of vocational education; I believe they can be highly simplified. The problem in part arises because of confusion in defining objectives. Take, for example, a list of supposed objectives provided in a New Jersey publication,[77] (developed by lay citizens, not by educators). The first one, to provide quality education and training for all people, plus the second, to provide people with salable skills, and the fourth, to provide realistic occupational education in all secondary schools, could all be listed under the main economic objective of maximizing the income for people who should be going through this program. The objective of providing quality education is essentially a platitude and not a goal.

The next goal, to use all public and private schools more effectively, simply says that, whatever our goals are, we will try to use resources efficiently. The very last goal, to develop close cooperation between education, industry, and labor, is the only one I could find that may express a realistic goal not related to income enhancement; and it is a subordinate goal.

I would say the other objectives cited by the panelists at the New Jersey conference are either irrelevant or are not really goals of vocational education. You certainly do not need a program of vocational education and training to improve collection and utilization of data on unemployment and job openings.

To expand existing and develop new school facilities as needed is an intermediate goal in Arnold Kotz's philosophy, aimed at getting resources into place, and not a final output-oriented goal or higher level goal.

I contend that there is only one goal and that is the economic goal of increasing income, plus a subsidiary equity goal of changing income distribution. This would manifest itself in the kind of population that we provide vocational education for. If I understood Dr. Stromsdorfer's paper, the equity goal is ignored and, in fact, there is a selection process in vocational education that, if anything, worsens the income distribution because it is giving the training to those people who could have obtained jobs any way.

The second issue raised is a very interesting one, and one which we have not discussed at all here. This is the issue of subsidy. There seems to be a clearcut line of connection between vocational education and the needs of industry. The implication of this is that there is a great deal of subsidization going on in the vocational education program. The school system is substituting for direct industry training. I am not criticizing the concept of subsidization: we subsidize industry through many programs. In this case, subsidization appears to be sub rosa. I think the whole question of which industries are to be subsidized, and how, should be explicitly stated, and perhaps considered as an objective of the vocational education program.

One possibility to consider is that subsidization should be confined to industries that are small scale, for which the public sector can provide economies of scale in the training program. It would seem to me that the case for subsidy is less defensible where you are doing the training for a large scale industry that could do the job as efficiently or better than vocational education can do it than it is for industries that would have to do this inefficiently on a small scale. There would be a very good case for this kind of program. Even here, industry may pay a share of the pay for these training programs. The taxpayer should not necessarily bear their full cost. I think this is a question that needs exploring and one we have not talked about here.

Next, I do not like Dr. Stromsdorfer's solution to the question of uncertainty. I do not think that uncertainty should be accommodated by raising the discount rate. The discount rate should reflect the social opportunity cost of capital. Uncertainty should enter in the benefit estimates, for example, by using stochastic estimating techniques. In other words, uncertainty affects variability of the solution, not the mean value.

The discounting procedure is very important; by the selection of the discount rate, you change radically the benefit/cost ratios. Rates too high will discourage potentially useful projects. In general, I believe that the social discount rate we are interested in is much lower than any presented in this conference. One reason that the social discount rates are generally too high is the failure to realize that a major government function is to serve as proxy for the future generation; to serve its interests, the discount rate must be low. Furthermore, either the valuation of benefits or the discount rate should take into account a productivity increase of about 2 to 3 percent annually. Rising productivity can be expected to increase benefits from any investment (mathematically it will have the same effect in the benefit/cost ratio if the productivity factor is subtracted from the discount rate).

Dr. Stromsdorfer:

I would like to make three points. Most benefit/cost studies underestimate costs and overestimate benefits, and the technique falls into disrepute. I think it is a better strategy and more sound to be conservative when you are in a situation of uncertainty. The philosophical notion of uncertainty means you have no knowledge at all, you cannot control, and you have no idea of the probability distribution of outcomes involved, so I think you should be conservative.

With respect to the social rate of discount, I do not know whether it is high or low and the studies are conflicting. Some people argue that this should be 8 or 9 percent, while some argue for a much lower rate of discount of 3-1/8 percent or lower. I am not convinced that either of these is correct.

The third point is that with respect to subsidy, the discussion here is running at cross purposes. The question to ask is: subsidy to whom? Are you subsidizing the firm or the individual? With respect to general skill training where a person's productivity is rated just as much for industry A as for industry B, or firm A or firm B, the subsidy is not for the industry or firm, the subsidy is to the individual. When you are talking about specific education, that is to say, training that raises a person's productivity only in firm A, and not in any other firm, that is a subsidy to the firm.

Dr. Davie:

Some manpower programs have that kind of objective. To read some of the literature from South Carolina, it sounds as if the reason that they are in the business of vocational education is to attract industries.

Mr. Righthand:

But the training in these manpower programs designed to attract industry could still be general training.

Dr. Stromsdorfer:

Society, or the individual, pays for it and thus allows firms to come in with a lower relative wage level and still compete for a labor force.

Dr. Hardin:

In connection with uncertainty, let me point out how large is the variability of outcomes for earnings. In our Michigan studies of the retraining program, there is a standard error of estimate of $1,600 for the gain in earnings from the year before the course to the year after the course. That means that for the individual who is average in all respects the estimate of the increase in his earnings from the year before to the year after, will, in two-thirds of the cases, lie between +$1,600 and -$1,600. In the Carroll and Ihnen study, there is a standard error of $72.40 per month. Multiply that by 12 and you get a fairly large standard error. I think we have to be aware that it is not enough just to calculate the average private rate of return, but we also have to look very closely at the dispersion of outcomes.

Next, it is in general erroneous to do evaluations just by comparing graduates of any particular course with non-trainees. It is more appropriate to compare the non-trainees with the enrollees (including the dropouts) if one wants to estimate the social rate of return or the private rate of return on a particular course. The drop-outs may benefit from being in the course even if they do not benefit as much as the graduates, or they may be harmed by the experience of not making it through the course. The aggregate benefits from the course would be overstated in the first case and understated in the latter. There is no really simple way to transform estimates of return based on graduates into the more appropriate estimates based on enrollees.

In Dr. Davie's paper, one problem that comes up is that Carroll and Ihnen use migration as an explanatory variable. I wonder how logical this is. Migration would usually be considered an effect of training. If you stick migration into a regression equation as an explanatory variable, part of the effect of training will be absorbed by this variable, but it will not look as if it is. Consequently, you may underestimate the benefits from training.

Finally, in the study of Gaston Tech by Carroll and Ihnen, the authors compared graduates of the school with people who, after graduating from high school had (1) not gone to Gaston and (2) not gone to any other school. I suspect there was a wide difference in motivation between these high school graduates and the Gaston Tech graduates. It is not easy to eliminate differences in motivation, but I think that if one is to do a thorough follow-up study, one must allow for this possibility and perhaps measure motivational aspects before the start of the course. This will help us keep motivation constant.

Dr. Fishman:

In view of the 11 different areas surveyed in the reconnaissance survey, it might be good to think in terms of doing several benefit/cost analyses in these different areas and spreading your net fairly widely in terms of the benefits. Hopefully, your best vocational education programs will give rise to the most benefits. In other words, one would hope that Pittsburgh or Connecticut or New Jersey would be areas in which you would come up with unique benefits. For example, it might turn out that vocational education graduates had a lower accident rate during their work life expectancy. Where there are programs in health training, resulting in a plentiful supply of health occupation skills, do you actually have a differential in sickness recovery rate or preventive disease rates?

Mr. Kotz:

I get the impression from Dr. Grosse's paper and from our considerations that a great deal of developmental work remains to be done before the results of benefit/cost analysis can be used effectively for planning and decision-making purposes in education. In terms of our reconnaissance survey, we found no benefit/cost analysis being conducted in any of the 11 communities, nor did we find any being conducted at the state level.

We did find a great deal of interest and some exploratory surveys. I think one of the things that Dr. Grosse did was to show the great lack and poor quality of data on which decisions are currently based. He could just as easily have said that because we have no data, HEW should freeze the level at current expenditure rates until we know more about what we are doing. I think it would have come out much the same way without raising so much of an emotional response as occurred when he indicated the low comparative values of vocational education shown by the economic analysis so far completed. In spite of the analysis done so far, we are still left to address the problem of what we do in a situation where decisions must be made and inadequate information exists. Dr. Grosse concluded that we need more research and data and that magnitudes of federal funds should be frozen at current levels until better data come in. He cited ratios of seat belt education of 1,100 to 1 in comparison to benefits in vocational education of $1.50 to every $1.00 of cost. But some of us think Dr. Grosse may be comparing incommensurables. In spite of his presentation, others think more funds should be made available for vocational education. Emotions run high on these issues, and resolution of them should have high priority on any research agenda.

We should try to bring out all the benefits, in terms of both monetary and nonmonetary values, and measure these for all the objectives of vocational education. Let us also consider effectiveness/cost analysis. You are, for example, placing graduates in jobs. The achievement of high placement ratios in training-related jobs is one of the current objectives of vocational education, and we do not know if we are doing it very well or very badly, but we can surely find out how it is most efficient to do it in terms of either an organic curriculum, a general track, or specific job training under MDTA. Can one achieve better results in job placement through on-the-job training than through classroom formal presentations? Can you achieve it better through public or private institutions? Effectiveness/cost analysis can answer such questions. You are not concerned with the rate of return in terms of dollar benefits. You are concerned with wanting to place a man in a job and with the behavioral outcomes desired. What are the costs for achieving a given placement ratio under alternative resource combinations?

In summary, I would like to raise the following questions: What do we tell a vocational education community about benefit/cost ratios and effectiveness/cost approaches? We find we do not have any meaningful results to provide to them now, but we certainly don't want to tell them to stop operating. What do we want to tell them? Should they eschew these approaches completely or should they use them? What importance and priorities should they attach to such studies? How do they go about conducting them? What factors must be included in benefits and what in costs. Who should conduct these studies? Should every community staff do them?

Chapter 18

A BENEFIT/COST FRAMEWORK FOR EDUCATION

By

Robert G. Spiegelman*

Introduction

The purpose of this paper is to establish a framework for the evaluation of educational programs. To establish such a framework, it is essential to understand the objectives of the programs to be evaluated, since the success or failure of a program can only be judged against those objectives. Certain objectives can be explicitly stated, defined in narrow terms, and related to a specific program--for example, the objective of increasing knowledge of American history. Other objectives such as the development of civic responsibility pervade the educational system and relate more to the goals of society.[78]

Although comprehensive program evaluation should take into account the whole range of legitimate objectives or goals set by society for its educational system, our present state of knowledge precludes consideration of some of the broader, more nebulous goals.[79] This study is concerned with evaluating the success of programs with relation to one set of societal goals--those dealing with economic objectives. The reason for selecting this set of goals is threefold: (1) they are clearly important; (2) they can be translated into terms susceptible to quantitative measurement; and (3) recent work shows that education can contribute to the realization of economic goals.

Edward Denison has estimated that in the United States in the period 1929-56, 42 percent of the growth in real per capita income can be ascribed to education.[80] Other works, using Census of Population data, have estimated that individual lifetime earnings are strongly influenced by the amount of education attained.[80-82, 54, 83-85]

Education goals should reflect "the complimentary commitment of a free society to equality and excellence."[86] In the sphere of economic goals, this statement reflects the dual need to attain rapid economic growth and to alleviate poverty, the latter goal requiring above average income growth for those at the lower end of the income distribution curve. Thus, programs such as Headstart and the Elementary and Secondary Education Act have been developed at the federal level to provide additional education for the children of economically deprived families, in the belief that more education will help these children overcome the burdens of a poverty background. If the value of these federal programs in education is to be ascertained and if decisions are to be made with regard to their content and direction, it is essential to determine whether the economic goals of income growth and poverty alleviation are in fact being attained.

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* Mordecai Kurz, Professor of Economics, Stanford University, assisted in the preparation of this paper, especially in the mathematical statement of the model. The author also wishes to acknowledge his debt to Professor Ernst Stromsdorfer, for his valuable comments on an earlier draft of the paper.

Application of Benefit/Cost Analysis to Education

The Principles of Economic Evaluation

Economic evaluation of projects is aimed at measuring the relative desirability of alternative projects in terms of economic criteria so that a rational choice can be made among them. A project may be broadly conceived, such as a program providing additional education to the poor, or narrowly conceived, such as a program to provide additional equipment in science classrooms. In either case, the program represents a marginal change in the education system of the United States and must be evaluated in terms of its marginal contributions to welfare. Much of the economic analysis of education to date is concerned with the average return to education--for example, the value of a high school education is calculated in terms of the average return to all high school graduates. This is satisfactory if the question to be asked is what contribution has education made to the total welfare of the nation, but it is not adequate to answer questions regarding the return to any specific new project in education. For many problems, this creates only small difficulty, because marginal returns may not differ significantly from average returns, but for other projects, the differences may be substantial.

In one sense, dealing with marginal changes in the education system may be easier than dealing with averages. The social returns to education expenditures clearly include the many noneconomic aspects mentioned previously. At this period in time, however, we have universal education, with almost all children attending school and 71 percent of those who enter the fifth grade completing high school. Under these conditions, the increases in attainment for some of the most basic societal education goals, such as preservation of democracy, civic responsibility, and social relationships, may be negligible with additional per capita spending on education. Thus, it may be more justifiable to concentrate on economic goals when considering marginal changes in the education system through new programs than when considering the average value of the whole system to society.

This premise, although not tested in the current study, supports the decision to concentrate on economic benefits--a decision that is based primarily on the need to limit this first attempt at rigorous analysis of educational programs to those benefits that appear most likely to yield to such analysis. The economic evaluation of a program consists of determining the monetary benefits less the costs of the program. Benefit/cost analysis, discussed below, provides a procedure for making this evaluation.

General Statement of the Benefit/Cost Approach

Benefit/cost analysis has been described as a "practical way of assessing the desirability of projects, where it is important to take a long view (concern for future as well as immediate effects) and a wide view (allowing for side-effects.")[87]

Benefit/cost analysis had application in the United States early in this century in the evaluation of river and harbor projects by the Army Corps of Engineers. The concept was broadened in the New Deal era to justify federal participation in flood control schemes. The Flood Control Act of 1936 authorized such participation "if the benefits to whomsoever they may accrue are in excess of the estimated costs." In general, benefit/cost analysis is a way of setting out information that needs to be taken into account in making certain economic choices. Essentially, the analytic task is to maximize the present value of all benefits less that of all costs, subject to specified constraints.[87] John Krutilla points out that this procedure does not differ from that of much economic analysis, but that the objective and the variables included in the analysis may differ.[88]

A major difference is that the benefit/cost calculus employed by public agencies must take into account the divergence between the private and social costs and benefits, a divergence that can be ignored by the private operator.

Essentially, the justification for using benefit/cost analysis is the failure of the market mechanism to achieve an efficient allocation of resources.[89] This failure is usually due to the existence of market imperfections, returns to scale, external economies, and so forth. It is important to note that there are various types of costs and benefits that can be called "external economies" but whose essential character is their inability to be appropriated; that is, in our existing market setup, these benefits cannot be appropriated by their producer. An example is a chemical plant producing smoke, thus yielding negative benefits that cannot--in our market mechanism--be charged against its revenues; so are the indirect benefits that a community derives for the education of its members. These benefits are those that occur above and beyond the pecuniary benefits of the educated person, and they reflect the overall improvement in the quality of life. Naturally, there is no market mechanism in existence to price them. It is hoped that the application of benefit/cost analysis can improve allocation of resources in these situations and contribute to the general welfare.

The general principles of benefit/cost analysis would be disclosed by answers to the following questions:[87]

1. Which costs and which benefits are to be included?

2. How are they to be valued?

3. At what interest rate are they to be discounted?

4. What are the relevant constraints?

Since benefit/cost analysis is an economic analysis, the costs and benefits to be included must be those that reflect the economic functions of the system; the benefits must be translatable into money terms, either constituting part of the national income account or a higher order of social benefit that can be translated into money terms. The costs must represent use of real resources.

The Enumeration of Benefits and Costs of Education

Essentially, education is a process of investment in people, or as stated by economists, a process of creating additions to the value of "human capital." Although the concept of investment implies economic criteria, the payoffs from the investment are likely to be more than simply economic. Weisbrod has identified three types of effects:[65]

1. Those that increase production possibilities. For example, labor skills could be increased by education.

2. Those that reduce costs and thereby make resources available for more constructive uses. For example, education could reduce crime and hence reduce the cost of law enforcement, thereby allowing the resources saved to be used for water supply, civic buildings, etc.

3. Those that contribute to the general welfare. For example, education could lead to a greater appreciation of the democratic system and thereby contribute to political stability.

We may add a fourth type of benefit, which may be termed "consumption benefits," i.e., those that directly increase an individual's enjoyment of life.

These benefits may be further divided into personal and social benefits; the former are those derived by the recipient of the educational inputs and the latter are those derived by other persons because of the recipient's education. Two important examples of these are (1) the intergeneration effects of educational attainment on the educational and occupational aspirations of children and (2) the effects of an educated person on the productivity of others, if these effects are not captured by the educated person in the form of his higher income (a prime example here is teachers).

The purpose of benefit/cost analysis is to permit an evaluation of a project (1) by itself--the sum of the benefits must exceed the sum of the costs and (2) in relation to other projects--the costs and benefits of one investment are compared with those of another. To accomplish these evaluations, it is necessary that benefits and costs be expressed in the same terms and that all benefits be reducible to a common denominator so that the sum of benefits from one project can be compared with the sum from others. These objectives are met only by having benefits and costs expressed in money terms, as noted previously. Thus, benefits that cannot be reduced to these terms, such as many of the third type listed above, cannot be included in the analysis. In addition, the present state of knowledge or the present availability of data restricts the number of benefits reducible to money terms. For these reasons, the benefit/cost analysis that can be performed for any education program at this time is at best a partial analysis. One thing is certain--if an education program shows a high positive value (benefits exceeding costs), the likelihood that the total benefits have not been counted may lead comfortably to the conclusion that the project is worthwhile.*

Personal or private benefits are those that accrue directly to the individual receiving the education and should be equal to the cash payments that the individual (or his family) is willing to make for the education. The social benefits are additional benefits that the individual shares with others. Both kinds of benefits can be further divided into those that are directly reflected in the national income accounts and currently measured in money terms and those that do not appear in the accounts, but may have a money equivalent (e.g., the consumption benefits to individuals or the benefits to society of support for democratic institutions).

The benefits to be included in this study are as follows:

- Increase in personal income due to graduating from high school and going to college.
- Reduction in the rate of unemployment.
- Reduction of juvenile crime.
- Intergeneration benefits.
- Increased labor force mobility.

Benefit/Cost Model for Education

The benefit/cost model will be developed in this study by analysis of one program, Title I of the Elementary and Secondary Education Act. To make this application, it is necessary that the model be relevant

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* This conclusion, however, is not wholly defensible. For example, additional education for disadvantaged and discriminated-against persons may have the short run effect of generating dissatisfactions that cannot be fulfilled, thus, leading to frustration, rioting, etc., and thereby diminishing total welfare.

to the particular segment of the population affected by the Title I program. This program is aimed at providing additional educational benefits to "disadvantaged" children, designated as those from low income families. Thus, in determining benefits, it is the poverty group whose characteristics and potentials must be measured. Although some of the analysis is applicable generally to all groups, there are at least two areas requiring special treatment:

1. The role of discrimination in limiting the private gains from education of certain groups.

2. Differences in motivations and aptitudes with regard to educational opportunities.

The purpose of this section is to present the general conceptual framework of the analysis. It will be presented as a mathematical model of benefits that we hope to estimate. In spite of the fact that we are primarily concerned here with the conceptual framework, we will make repeated references to methods of estimation. This is desirable because the methods of estimation will cast light on various aspects of "benefits" that are "social" rather than "private."

From an abstract point of view, we can visualize the "education industry" as one that takes children with certain characteristics and embodies human capital (knowledge) in them. Thus, the two factors determining the nature of this productive process are the characteristics of the children and the characteristics of the school inputs. A Title I project is expected to influence the educational environment and alter the characteristics of the school inputs. Title I projects in a given school have two main effects:

1. The primary effect of the program is to increase the learning capacity of the children. Since their attainment level is increased, it is argued that they are "more educated." This means that there is more human capital embodied in these children, thus increasing their earning capacity.

2. There are secondary effects of this increased learning capacity, and these may be more important. The secondary effects are the increased probability of staying in school, the increased probability of graduating and going on to higher education, and the reduced probability of becoming juvenile delinquents.

The difference between effects 1 and 2 is basic to our approach. Effect 1 could simply be measured in terms of the educational content of the programs and their effectiveness in raising learning capacity; effect 2, however, involves intrinsically uncertain outcome in the sense that the program only changes the probabilities of occurrences of desired events, such as graduation. Thus, our approach calls for estimating the various probabilities involved in the process.

The Basic Structure: Effectiveness

As we have argued above, the effects of Title I projects may be classified into: (1) the primary effect of increasing educational content during the operation of the program and (2) the secondary effects of the increased learning on the probability of graduating from high school, etc.

With respect to these basic effectiveness equations, any given child has a set of characteristics (k,a,v,r,s). See set of symbols, Table V-14. For simplicity, we will denote a set of characteristics by the letter ϵ so that when we talk about the benefits for a child with certain characteristics, we shall write it $B(\epsilon)$ with the understanding that ϵ stands for an arbitrary set of characteristics. The full notation would be $B(k,a,v,r,s)$.

Primary Effectiveness.* As already stated, during the time when the program is in progress, children learn more and their attainment level is increased. Now let $R(\epsilon)$ be the private pecuniary returns to education of a child with characteristic ϵ. This would usually be measured by the difference in potential income between a person with education v and a person with one year less education, v-1:

$$R(\epsilon) \equiv R(k,a,v,r,s) = Y(k,a,v,r,s) - Y(k,a,v-1,r,s)$$

where Y stands for the income potential of a child with the stated characteristics and where the $R(\epsilon)$ term is the marginal return to a year of education between v-1 and v.

Now suppose the program lasts T periods. During the T periods of the Title I programs, educational achievement has been increased by a certain educational-equivalence content τ. Hence, during T periods of Title I, the child's level of education is increased by what is equivalent to τ years of schooling. In general, τ is small, since the increase in educational attainment is bound to be equivalent to only a fraction of the elapsed time in the program. Thus, the primary benefits, B_p, of Title I for a given school group, ϵ, may be approximated as follows:

$$B_p(\epsilon) = \tau R(\epsilon). \qquad (1)$$

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* Note that we are using the term "effectiveness equation" rather than "benefits equation" since these equations represent the more fundamental effects of the programs and all other benefits will be computed on the basis of the information provided in the so-called effectiveness equations.

Table V-14

SYMBOLS USED IN BENEFIT/COST MODEL

k = region
a = age
v = schooling
r = race
s = sex
let ε = a set (k,a,v,r,s)
B = benefit
Y = income potential; $Y(\varepsilon)$ is income potential of a child with characteristics: i.e., expected earnings of a fully employed person with characteristic
R = gross returns to education
ρ = rate of return per year on private capital
T = length of time interval for Title I projects
γ = educational achievement in terms of months of schooling
X_i = set of i school characteristics subject to change by Title I
y_i = set of i child-family characteristics, other than ε
P = probability: superscripts (i.e., g,d,j,E) signify the event and subscripts the sub-set of the population affected: Thus P_g^E is probability of a high school graduate being employed.
g = high school graduate
d = high school dropout
j = juvenile delinquent or criminal
p = primary effect of Title I
E = employment
C = cost of education
c = college graduate
cd = college dropout
k,g,d,c as subscripts represent a particular characteristic of the affected population; thus $Y_k(\varepsilon)$ is income potential for a member of group ε with characteristics (a,v,r,s) in region k
M = mobility
L = level of education of present generation
ℓ = level of education of child of the next generation

The reason for Equation (1) is as follows: the increase in income potential due to one year of schooling is $R(\epsilon)$ and since τ is usually a small fraction of a year, then $\tau R(\epsilon)$ is the increase in income potential due to τ years.

The Probability of Graduation. First, let us distinguish between school characteristics that can be altered by Title I programs and child-family-environment characteristics that cannot.

$x_i \ldots x_m$ = the indicated characteristics of the school

$y_i \ldots y_n$ = the child-family-environment characteristics not affected by the programs

For any child, the probability of his graduating from school when he has the characteristics can be expressed as:

$$P^g(\epsilon) = \sum_{i=1}^{m} \alpha_i^{\epsilon} x_i + \sum_{i=1}^{n} a_i^{\epsilon} y_i \qquad (2)$$

This probability function may be different in different regions, at different ages or levels of education, and for different sexes or races, thus the parameters α_i^{ϵ} and a_i^{ϵ} depend on ϵ.

Since we assume that Title I alters only the school characteristics, in our analytical framework, a collection of Title I projects means known changes in the x_i variables--i.e., "Title I projects" means a collection of $(\Delta x_1, \Delta x_2, \ldots \Delta x_m)$. Naturally, for alternative cost levels, program compositions and schools, the Δx_i will vary. However, for any given school, such programs are assumed to be known, thus, the level of the programs and their composition generate a specific set of values for Δx_i.

In its simplest form, the Δx_i may be aggregated into a single variable (Δx_1) representing expenditure per pupil in the program.

It follows that Title I programs alter the probability of graduating through their alteration of the x_is such that, if we denote by $\Delta P^g(\epsilon)$ the change in probability of graduation of a child with characteristics ϵ, then

$$\Delta P^g(\epsilon) = \sum_{i=1}^{m} \alpha_i^{\epsilon} \Delta x_i \qquad (3)$$

Equation (3) gives the second basic "effectiveness equation;" all other benefits will be either derived from Equation (1) or from the change in probability expressed in Equation (3).

The Probability of Juvenile Delinquency. There are two ways of treating the problem of juvenile delinquency. The first approach, which is probably the sounder one, is to apply the same procedure as in the case of graduation. Thus the probability, P^j, of a child with characteristics ϵ becoming a delinquent is expressed as follows:

$$P^j(\epsilon) = \sum_{i-1}^{m} \beta_i^\epsilon x_i + \sum_{i=1}^{n} b_i^\epsilon y_i \tag{4}$$

and the effect of Title I programs is expressed by

$$\Delta P^j(\epsilon) = \sum_{i=1}^{m} \beta_i^\epsilon \Delta x_i \tag{5}$$

Equation (5) gives a third effectiveness equation.

The estimation of Equation (4) is very difficult owing to the absence of appropriate data; an alternative hypothesis, which would be easier to quantify, is to express the probability of being a juvenile delinquent as a function of the probability of being a high school graduate; thus

$$\Delta P^j(\epsilon) = \gamma \Delta P^g(\epsilon). \tag{6}$$

According to this hypothesis

$$\sum_{i=1}^{m} \beta_i^\epsilon \Delta x_i = \gamma \sum_{i=1}^{m} \alpha_i^\epsilon \Delta x_i \tag{6'}$$

Clearly, if each coefficient satisfies $\beta_i^\epsilon = \gamma\alpha_i^\epsilon$, Equation (6') is a good hypothesis. However, its assumption--that the change in probability of graduation due to the Title I programs is proportional to the change in the probability of being a juvenile delinquent--leads to a rather simple calculation that requires the estimation of γ only.

From the basic effectiveness equations, we propose to derive all the individual benefits. The next section is devoted to this derivation.

Evaluation of Individual Benefits

As already mentioned, there are two classes of benefits: those that accrue as a primary effect of the program and those that are less certain and that will accrue as secondary effects of the program in the form of altered probabilities of each event occurring.

The primary benefits during the life of the program have been stated in Equation (1) above as

$$B_p(\varepsilon) = \tau R(\varepsilon).$$

The rest of the benefits to be discussed in this section are of the "derived" nature, i.e., derived from the altered probabilities. Before proceeding to these benefits, let us re-examine Equation (1). Suppose we take a child of age 12 with 6 years of schooling so that his vector of characteristics is (k,12,6,r,s). Let us now examine the use and meaning of the equation

$$B_p(k,12,6,r,s) = \tau R(k,12,6,r,s) = \tau\Big[Y(k,12,6,r,s) - Y(k,12,5,r,s)\Big].$$

It is obvious that there is one element that we have not specified: the time at which the benefits are expected to accrue. The child is 12 years old, and his potential benefits can start accruing at the age of 14. Thus, if we define "the present" as time t = 0, then the potential benefits in year t can be defined by

$$B_p(k,12+t,6,r,s) = \tau\Big[Y(k,12+t,6,r,s) - Y(k,12+t,5,r,s)\Big] \; ; \; t \geq 2$$

Since it is assumed that a person can work until the age of 65, t can run over 51 periods. If we let λ be the discount factor, then the present value of all these benefits is

$$B_p = \sum_{t=2}^{53} \frac{\Big[Y(k,12+t,6,r,s) - Y(k,12+t,5,r,s)\Big]}{(1+\lambda)^t}.$$

This is the component that finally goes into the benefit/cost calculus.

Now we can answer the original question regarding "the meaning of Equation (1)." This equation does not represent the calculations of the present value but rather specifies the theory of the instantaneous benefits at any moment of time and where the time element is appropriately considered. The transformation from instantaneous (timeless) benefits to present values entails the explicit introduction of the time element, the discount factor, and the present value calculus. In what follows, we will avoid these considerations that are standard procedure and concentrate on the theoretical considerations leading to the equations of instantaneous benefits. This is done for the sake of simplicity and expositional clarity.

Graduation and Its Income Effect. Recall that $\Delta P^g(\varepsilon)$ is the increased probability of graduating. Naturally, graduating from high school has a private value over dropping out, consisting of two effects:

1. A fully employed graduate earns higher income than a fully employed dropout.

2. Graduates tend to have a higher probability of being employed.

Now define $\Delta Y(\varepsilon)$, the expected increase in income resulting from graduation, compared with the expected income of dropouts:

$$\Delta Y(\varepsilon) = \left[Y_g(\varepsilon), - Y_d(\varepsilon)\right] \quad P_g^E(\varepsilon) + Y_d(\varepsilon) \left[P_g^E(\varepsilon) - P_d^E(\varepsilon)\right] \qquad (7)$$

The Equation (7) consists of two terms: (1) the employment probability for the graduate times the difference in income potentials and (2) the income potential of the graduate times the difference in probability of a graduate and a dropout being employed. It is clear that Equation (7) can be reduced to $\Delta Y(\varepsilon) = Y_g(\varepsilon)\ P_g^E(\varepsilon) - Y_d(\varepsilon)\ P_d^E(\varepsilon)$. This is a different way of measuring $\Delta Y(\varepsilon)$: $Y_g(\varepsilon)\ P_g^E(\varepsilon)$ is the expected income of a graduate while $Y_d(\varepsilon)\ P_d^E(\varepsilon)$ is the expected income of a dropout. The difference between them measures the expected income gain at graduation.

Suppose that the total cost of education to carry the child from the time the program ends to graduation is $C(\varepsilon)$. These funds have an alternative use, the value of which is determined by the rate of return on private capital, ρ. Thus, the alternative value of the funds spent on education is $C(\varepsilon)\rho$; hence, the total net benefits are:

$$\Delta Y(\varepsilon) - C(\varepsilon)\rho$$

Finally, since Title I projects increase the probability of graduation by $\Delta P^g(\varepsilon)$, it follows that the expected graduation income benefits of Title I are:

$$B_g(\varepsilon) = \Delta P^g(\varepsilon) \quad \left[\Delta Y(\varepsilon) - C(\varepsilon)\rho\right] \qquad (8)$$

We remind the reader that equations like (8) measure expected *instantaneous* benefits at some point of time in the future. To do this, we had to take the capital costs $C(\varepsilon)$ and convert them via ρ to a flow of cost that can be compared with the instantaneous benefits $\Delta Y(\varepsilon)$. The multiplication by $\Delta P^g(\varepsilon)$ is done to compute the expected effect of Title I projects.

The College Option Benefits. To continue his studies beyond high school, the student must graduate from high school. Thus, graduation yields an additional benefit in the form of an option of continuing studies in college.[111]

Let

$Y_c(\varepsilon)$ = the income of a college graduate with characteristics ε

C_c = the investment cost of college studies

ρ = the rate of return on private capital.

Then

$$\Delta R_c = \left[Y_c(\varepsilon)\, P_c^E(\varepsilon) - Y_g(\varepsilon)\, P_g^E(\varepsilon)\right]$$

is the difference between expected earnings of college graduates and those of high school graduates. However, the fact remains that only the net benefits of the option count, so that we calculate

$$\Delta R_c - C_c \rho$$

as the net benefits of completing college. Now consider the fact that only a fraction, P^c, of all eligible high school graduates have the ability and motivation for going to and completing college. The option benefits apply only to this fraction. Thus, for the randomly selected individual, the option benefit is worth only

$$P^c \left[R_c - C_c \rho\right] .$$

Finally, the true benefits due to the Title I program would be given by the change in the probability of graduating high school times the college option benefit.

$$B_o(\varepsilon) = \Delta P^g(\varepsilon) \left[R_c(\varepsilon) - C_c \rho\right] P^c(\varepsilon). \qquad (9)$$

One can expand this discussion by considering the option of going to college as really being composed of two parts: one is the option of having some college (with return R_{cd} and cost C_{cd}) plus the option of completing college (analyzed above). Then we have the following: Let $P^{cd}(\varepsilon)$ be the proportion of high school graduates that continue their studies in college but do not complete it. The expected option benefit of this is

$$\Delta P^g(\varepsilon) \left[R_{cd}(\varepsilon) - C_{cd} \rho\right] P^{cd}(\varepsilon).$$

Recalling that P^c is the probability of going to college and graduating, we finally have the total college option benefits

$$B_o(\varepsilon) = \Delta P^g(\varepsilon) \left[R_c(\varepsilon) - C_c \rho\right] P^c_{(\varepsilon)} + \Delta P^g(\varepsilon) \left[R_{cd}(\varepsilon) - C_{cd} \rho\right] P^{cd}. \qquad (10)$$

The difference between Equation (10) and Equation (9) is to be found in the second expression of (1). It measures the option benefits associated with the attainment of some college education. Thus, the theory behind Equation (9) attributes option benefits only to college graduation while the theory behind Equation (10) assigns option benefits both to college graduation and to the attainment of some college education. The statistics indicate that there are significant benefits to attaining some college education, thus Equation (10) represents a more realistic evaluation of the benefits.

Mobility Benefits. The probability that an individual will move from one region of the country to another may depend on many factors. Thus, if P_{AB} is the probability of mobility from A to B and P_{BA} is the probability of mobility from B to A, then if the two regions are the same economically, geographically, and socially, we should expect $P_{AB} = P_{BA}$. This means that there will always be some "mobility noise" between any two regions purely because of changing tastes, varying economic conditions, etc. However, if there are distinctive differences between regions, then $P_{AB} \neq P_{BA}$. It is generally assumed that the existence of net immigration between regions reflects differential economic opportunity.

If all factors of production, including labor, were perfectly mobile, one would expect all factors to receive the same return (adjusted for transport cost) in all regions. However, this is not the case, since mobility is not perfect. Thus, if education in some way can increase the willingness and ability to move, educated individuals will be more capable of taking advantage of greater benefits available outside the regions in which they reside.

Since Title I programs are available to children in different regions, some of them may attain the additional benefits because of their greater capacity to move to more rewarding areas.

Now consider an individual in group ϵ. By our previous notation, his income expectation in his own region K is $P^E(k,a,v,r,s)\ Y(k,a,v,r,s)$. Now define

$$\bar{Z}(a,v,r,s) = \max_k \left[P^E(k,a,v,r,s)\ Y(k,a,v,r,s)\right].$$

That is, $\bar{Z}(a,v,r,s)$ measures the maximal expected income that a person with characteristics (a,v,r,s) can attain, where maximization is over the regions of the country. In fact, suppose $\bar{k}$ is the region where the maximum occurs, then obviously

$$\bar{Z}(a,v,r,s) = P^E(\bar{k},a,v,r,s)\ Y(\bar{k},a,v,r,s).$$

If we search for the potential benefits from mobility, then by moving to the best region, an individual can increase his expected income by

$$\bar{Z}(a,v,r,s) - P^E(k,a,v,r,s)\ Y(k,a,v,r,s).$$

Naturally, if the region of residence is $k = \bar{k}$ then the above expression is 0, indicating no potential benefits from mobility.

If an increase in education because of Title I changes the probability of mobility for an individual in a class by $\Delta P^M(\varepsilon)$, then the total expected benefits from increased mobility are

$$B_M(\varepsilon) = \Delta P^M(\varepsilon) \quad \bar{Z}(a,v,r,s) - P^E(\varepsilon)\ Y(\varepsilon). \tag{11}$$

One step missing in this discussion is the association between $\Delta P^M(\varepsilon)$ and Title I projects. This association can be established in two steps: (1) we know that a T period Title I program is equivalent to τ years of schooling, and thus the direct effect is $\Delta \hat{P}^M(\varepsilon)$, where $\Delta \hat{P}^M(\varepsilon)$ is the change in probability due to one year of schooling; (2) since, however, $\Delta \hat{P}_M(\varepsilon)$ is only an approximation, consider the difference

$$P_g^M(\varepsilon) - P_d^M(\varepsilon)$$

as being the difference in probability of mobility between an individual in group ε who graduates from high school and one who does not. Title I can affect mobility by changing the probability of being a graduate. Thus, the mobility increase due to Title I is given as:

$$\Delta P^g(\varepsilon) \quad \left[P_g^M(\varepsilon) - P_d^M(\varepsilon)\right]$$

Thus the total increase $\Delta P^M(\varepsilon)$ is

$$\Delta P^M(\varepsilon) = \tau \Delta \hat{P}^M(\varepsilon) + \Delta P^g(\varepsilon) \quad \left[P_g^M(\varepsilon) - P_d^M(\varepsilon)\right] \tag{11'}$$

To clarify Equation (11') note first that it aims to estimate the increase in probability of mobility due to Title I projects. Second, we have the increased educational content measured by τ years of education. Thus if--per year of education--the increased frequency of mobility is $\Delta \hat{P}^M(\varepsilon)$, then the increase of τ years of education contributes $\tau \Delta \hat{P}^M(\varepsilon)$ to the probability of mobility. Third, increased mobility may be the result of graduation, which is a random event. If $P_g^M(\varepsilon) - P_d^M(\varepsilon)$ is the differential frequency of mobility between graduates and dropouts then, under the assumption of (stochastic) independence, $\Delta P^g(\varepsilon) \left[P_g^M(\varepsilon) - P_d^M(\varepsilon)\right]$ measures the increase in the probability of mobility due to the increased probability of graduation resulting from Title I projects.

The Benefits of Reducing Juvenile Deliquency. We have seen earlier that from the effectiveness equations, we can compute $\Delta P^j(\epsilon)$--i.e., the change in the probability that a youth of group ϵ will become a juvenile delinquent. Hence, it is only necessary to translate this change in probability to the benefits that may be yielded by it.

Suppose that we consider the income stream of a youth in group ϵ under two separate conditions: (1) assuming that he is a juvenile delinquent and (2) assuming that he is not. Let $Y_j(\epsilon)$ be the income of a youth who becomes a juvenile delinquent and let $Y(\epsilon)$ be the income of the same youth if he is not a juvenile delinquent. The difference in income stream of a juvenile delinquent and a nondelinquent is:

$$A_j(\epsilon) = Y_j(\epsilon) - Y(\epsilon). \tag{12}$$

Where $A_j(\epsilon)$ measures the private loss of income due to delinquency, naturally we would expect $A_j(\epsilon)$ to be a negative number. Since $\Delta P^j(\epsilon)$ measures the change in probability of becoming a juvenile delinquent--due to Title I, we expect $\Delta P^j(\epsilon)$ to be a negative number and the expected benefits $A_j(\epsilon)\ \Delta P^j(\epsilon)$ to be a positive number.

However, in the case of juvenile delinquency, we can extend benefits to include some social benefits. Let $C_j(\epsilon)$ be the average social cost of juvenile crime per criminal, including the direct costs of protection, apprehension, adjudication, and incarceration, plus the social effects of the crime itself, including personal and property damages and psychic losses. It is clear that using such an average represents a gross simplification; however, as a first approximation, we assume society to save $C_j(\epsilon)$ dollars with a reduction of the number of delinquents of category ϵ by one. Since the effect of Title I projects is to increase this probability by $-\Delta P^j(\epsilon)$, the expected social savings amount to $-\Delta P^j(\epsilon)\ C_j(\epsilon)$. It then follows that total benefits would be

$$B_j(\epsilon) = \Delta P^j(\epsilon) \quad A_j(\epsilon) - C(\epsilon). \tag{13}$$

Intergeneration Benefits. Intergeneration benefits are those that accrue to the offspring of the generation currently being educated. These benefits result from the association between the educational attainment of parents and their children. It has been estimated, for example, that the child of a parent who had only elementary school education can be expected to have 2.6 fewer years of education than a child of a parent who was a college graduate.[90] Thus, one social benefit of increasing the education of the present generation is the higher educational attainment that can be expected from future generations without any additional programs for that generation.

Letting $\ell(\varepsilon)$ be the number of years of education of the offspring, the relationship between the education of parent and children may be expressed as follows:

$$\ell(\varepsilon) = f[L(\varepsilon)] \tag{14}$$

Since the function $f(x)$ can be expected to be monotonic increasing, its derivative satisfies the condition that $f'(x) \geq 0$.

Now, for every change $\Delta L(\varepsilon)$ of the education level of the parents, we would expect the educational level of the offspring to change by:

$$\Delta\ell(\varepsilon) = f'[L(\varepsilon)]\,\Delta L(\varepsilon)$$

so that any change in the educational level of the father $\Delta L(\varepsilon)$ leads to change in the educational level $\Delta\ell(\varepsilon)$ of the offspring.

We may assume that additional education will mean as much to the future generation as it means to the present generation, except that it will occur at a later point in time. Therefore, in the discounting procedure mentioned earlier, the starting point of the present value calculation is a generation hence. The benefits to the future generation are then expressed as related to the change in education of the present generation as follows:

$$B\ell(\varepsilon) = f'[L(\varepsilon)]\,B(\varepsilon). \tag{15}$$

The personal benefits to the present generation can be expected to be some fraction, λ, of the benefits derived by the next generation, but there is no simple way of estimating λ. The question to be answered in determining the value of λ is: "What is the rate of substitution between our income and that of our offspring? The answer will vary significantly between individuals, since each person values the benefits to his children differently.

It seems that most parents are willing to pay a great deal for their children's education, so that we can assume that λ is large. In equilibrium, the son would spend on education an amount equal to his expected discounted lifetime earnings; thus, we could estimate λ as the proportion of the cost of the son's education that the parent is willing to pay. That is, if we could conduct an experiment to find out what is the maximum amount that individuals are willing to pay for the education of their children and if we compared this amount with the actual cost of education, we would get an estimate of λ. Thus, the benefits to the present generation from the induced increase in the next generation's education is given by the following:

$$B_G(\varepsilon) = \lambda B\ell(\varepsilon). \tag{16}$$

Potential Benefits, Actual Benefits, and Social Benefits

In our developments described earlier, we have used the difference, say, $Y_g(\epsilon)-Y_d(\epsilon)$, very often. This difference was argued to be the measure of the expected increase in income of a dropout in group ϵ, if he graduates. The difficulty that this measure creates is related to our basic distinction between private and social benefits. Thus, the difference $Y_g(\epsilon) - Y_d(\epsilon)$ is indeed the expected increase in earnings of this individual. But note that if this individual is a Negro who is being discriminated against, this difference does not measure the true level of social benefits, since it is most likely that the productivity level of a Negro is equal to that of a white man with the same education although his income is less; thus, the difference in earnings between the Negro and the white man performing the same task is transferred either to corporate profits or to consumer surplus. Thus, the presence of this discrimination means that for the same occupation and level of education, the white worker's salary is a better measurement of the Negro worker's productivity than the Negro worker's salary. Because of these considerations, we have estimated additional social benefits for all ϵ groups of Negroes on the basis of their white workers' equivalent salaries. Discrimination that results in Negroes' performing tasks typically performed by whites with less education represents a reduction in total benefits below the amount potentially available. This reduction in benefits will be taken into account in calculating total benefits by adjusting the expected benefits from educating Negroes for the differences in the occupational distribution of whites and Negroes at each level of education.

A similar problem has arisen in the estimation of social benefits to women. A large number of women in the labor force work only part-time by choice, and many women do not enter the labor force--e.g., are housewives. The benefits imputed to women's education on the basis of their rate of participation in the labor force are understated. The actual benefits of education to women not in the labor force, or to women working part-time, are greater than their earnings, since they usually have the option of working full-time. The failure to exercise this option means that the nonmonetary benefits of raising children, running a household, or participating in other social activities are greater than the benefits of the foregone income.*

Thus, the benefits of high school graduation for all women, regardless of whether they work full-time or part-time or do not work at all

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* The term "option" is used here in the broad social sense of an alternative permitted by the operation of the market. It does not mean that every individual has an effective option at every point in time. For example, a housewife with six children gave up her option to work at an earlier time.

(out of their own choice), are to be computed as the difference $Y_g(\epsilon)$ - $Y_d(\epsilon)$ for fully employed women in the ϵ category. Although this procedure may still underestimate the true benefits that accrue to the female population, it provides an estimate of the social value of a housewife's services as being equal to the opportunity cost of her labor.

Total Benefits

In the discussion above, we have analyzed the different types of benefits that accrue to each individual in each group (k,a,v,r,s). To obtain the total benefits of the program, we have to add up the benefits over individuals in each group participating in Title I programs and the benefits over groups.

Chapter 19

SUMMARY GUIDE FOR EFFECTIVENESS/COST AND BENEFIT/COST ANALYSES OF VOCATIONAL AND TECHNICAL EDUCATION: A REPORT OF THE CONFERENCE

By

Einar Hardin

Introduction

This guide covers only technical aspects of effectiveness/cost analysis and benefit/cost analysis of vocational and technical education. It is neutral as to the exact definition of vocational and technical education and uses the terms "training" and "trainee" to denote such education and any person enrolled in it. The guide is also neutral as to the aspects of vocational education that are to be analyzed and as to the exact criteria and indices of performance to be used in valuing the outcomes of education.

Effectiveness/cost analysis is less controversial than benefit/cost analysis in one important sense: It does not require the analyst to specify a monetary index of performance to be used in combining the output variables into a single measure, while benefit/cost analysis requires him to do so. This report accordingly discusses effectiveness/cost analysis first, followed by a shorter statement on benefit/cost analysis.

Effectiveness/Cost Analysis

Effectiveness/cost analysis of training activities is a methodological framework for making numerical estimates of the effects of particular training activities on selected output variables and estimates of the costs of obtaining these effects.

Output Variables

The analysis may estimate the performance of one or several output variables. The list of such variables is limited only by the interests and resources of the analyst and his client and by the *a priori* judgment as to what variables are not affected by training. The variables need not be economic in either a broad or narrow sense, but can in principle be of any nature. The discussion of output variables below is therefore only suggestive.

One group of variables refers to the trainee's performance at the end of training. These may include knowledge, skills, motivation, and other aspects of personal behavior, and they may be measured by direct observation or by oral or written tests. A second group of variables refers to the person's performance in the community and the organization in which he becomes employed. These may include the types of personal behavior variables just mentioned or several aspects of labor market performance. Illustrations of the latter are the annual earnings of the person (as well as the components of these earnings; that is, hourly earnings and annual hours worked), employment stability, labor force participation, skill level of regular job held, degree of utilization of training knowledge and skills in employment, receipt of unemployment insurance benefits or welfare assistance, and geographic mobility.

Estimating the Effects of Training on the Output Variables

The technical problems of estimating the effects of training on the selected output variables are essentially the same as the problems of estimating the effects of any treatment, and an extensive literature exists on the use of experimental and survey methods to estimate effects. The report is, therefore, confined to some of the major problems that one may expect to encounter in estimating the effects of training.

The Necessity for a Control Group Design. With virtually no exceptions, one cannot estimate quantitatively and reasonably accurately the effects of training on output variables unless a control group design is used in the analysis. It is unsatisfactory simply to use the values of the output variables among the trainees after the end of the course, since this use would imply that the values would have been zero in the absence of training. It is often equally useless to compare the values of the output variables for the period after the course with the values of the corresponding output variables before the course, since these values may change over time even among persons who do not receive training. This is particularly true when the output variables represent aspects of labor market performance. Generally, the best design is to compare the output variables of trainees with those of comparable nontrainees.

Choosing the Control Groups. Control groups should be chosen on the basis of two criteria. The first is logical relevance: The control group must represent an acceptable alternative form of treatment (including possibly no treatment at all) with which the treatment in question is to be compared. The other criterion is that of statistical equivalence: The control group members should be comparable to the trainees in terms of their characteristics, such as age, sex, race, and education. Statistical equivalence is most safely achieved when a strict experimental design is used. When, as is usually the case, a strict experimental design is not feasible or permissible, subjective judgment of the degree of comparability must be used, and the results are no better than the quality of this judgment. Fortunately, it is often possible to use a multivariate statistical analysis to compensate for minor lacks of comparability between experimental and control groups.

When to Choose the Control Groups and Collect Initial Data. Control groups should preferably be established at the time that recruitment for the course is under way. It is usually very difficult to identify the control groups and assess their comparability with the experimental groups if this activity is undertaken at a later time. If data on initial knowledge, skills, and attitudes are needed to increase the accuracy of the estimates, these must naturally be collected before the course gets under way.

Adequate identification of trainees, control group members, and their respective sociodemographic characteristics is essential to any evaluation. Because of its extensive and growing use, the social security number is the main key to identification and should be included in all records of individual persons involved as participants and potential controls for courses that one may wish to evaluate. Other essential identifiers, in addition to the full name, are sex and date of birth.

Building the Evaluation Design into the Training Activity Design. Courses that are designated as experimental and demonstration projects lead to a waste of resources and of potential learning if an evaluation design is not built into the design of the training activity. Proposals for experimental and demonstration projects should not be undertaken unless they include an adequate and concrete design for evaluation.

Comparison of Treatments. Several different treatments may be compared within the framework of a single design. For example, it would be possible to determine the relationship of the length of the training course to the effect of training on the output variable. A major advantage of an experimental design is that the same control group may be used for several treatments, thus reducing the number of observations needed for a given level of accuracy.

Period of Observation After Treatment. Once a treatment is completed, the effect of a treatment may grow or decline over time. The choice of the period of observation after the end of the treatment should therefore be long enough to permit any such trends in effects to emerge. When the output variable consists of annual earnings or almost any other important labor market variable, a period of several years should generally be used, but no satisfactory information is currently available about the necessary length of the observation period. When adequate resources are available, intermediate results may be obtained through successive follow-up studies.

Sources of Data. The measurement of classroom performance variables may require the construction and validation of psychological tests, including trade tests. If the alternative treatment is "no treatment," it would often be necessary to administer the same tests not only to the trainees but also to the control group, both before and after the treatment. Because of the great expense of required field work, "no treatment" alternatives needing field work, should be chosen only after careful deliberation of their logical relevance.

When the output variables consist of aspects of labor market performance, extensive field work is usually required. In a few states, the employers are required to report the earnings of covered employees to the state government with no ceiling on the amount reported, an important difference from the reports made to the Social Security Administration. In these so-called wage reporting states, it may be possible to obtain very satisfactory information on annual wage and salary earnings and possibly other labor market aspects directly from state government records. In other states or when other types of variables are used, the necessary information can usually be obtained only in time-consuming, difficult, and expensive field survey operations.

Input Variables

The effect of training on the output variables may be contingent on a number of circumstances. These variables taken together with the variable or variables representing the fact, kind, or amount of training may be called the input variables. The input variables need not be economic, either in a broad or a narrow sense, but can in principle be of any nature, and variables having economic relevance need not be expressed in economic or monetary terms.

In most instances, however, the cost of training is not fixed but depends on the magnitudes of several variables. The list of input variables used in the design to estimate effects should then include all variables having cost implications.

The Costs of Training

Theoretically, the costs of training need not be expressed in monetary terms. In practice, it is difficult, however, to find any other common denominator. The cost element in effectiveness/cost analysis is, therefore, almost always expressed in monetary terms. Nonmonetary sacrifices incurred because of the activity must then either be expressed in monetary terms, which is difficult to do, or be considered separately and subjectively by decision-makers.

A distinction must be made between the costs that society incurs by undertaking the training activity, the costs that a particular government agency incurs because of it, and the costs that the individual participant incurs by enrolling. Most effectiveness/cost analysis appears to be based primarily on the first concept of costs and secondarily on the second concept. In contrast, benefit/cost analysis is based primarily on the first and secondarily on the third concept.

Concept of Social Cost. From the point of view of society, the cost of training may be defined as the value of the productive resources used up in providing the training. These consist of instructional resources, administrative resources, additional resource use by trainees because of training (travel and extra maintenance expenditures as well as school supplies), and the productive manpower of trainees that is not available to society while the training course is in progress.

The last item of cost, loss of productive manpower, is approximated by the amount of earnings lost by the trainees while they are in training. The design used in measuring the effect of training on the outcome variables must also be capable of estimating the amount of earnings lost because of training.

The first three items of cost mentioned above have often been measured by the accounting expenditures on training and related administrative activities. Such a measure is often seriously defective. For example, when capital equipment is acquired for a course, the social cost does not consist of the entire expenditure on acquiring the equipment but only of some portion corresponding to the amount of use that the particular course makes of the equipment. The expenditure should be replaced by the depreciation on the equipment and to the depreciation item should be added a social interest charge for the equipment. Furthermore, in the case of variable inputs such as manpower and supplies, the cost should refer to the value of the resources used up by the activity. Care must be taken to adjust these costs properly whenever the expenditures charged to the activity or to the agency undertaking it do not represent full resource use. Much care is needed and much improvement in government accounting concepts and procedures is required before the social cost of training can be measured satisfactorily.

Transfer Payments Versus Social Costs. The expenditures of society on unemployment benefits and welfare assistance and the tax receipts of society may change because of the altered earnings of trainees resulting from training. If social cost is defined as the value of the productive resources used up by the training activity, which is the customary definition, it is improper to regard the reduction in unemployment benefits and assistance payments and the increase in individual tax payments brought about by training as a minus item in the cost of the activity. These constitute transfers among persons in society and do not reflect in any direct way an alteration in resource use. Transfer payments may be considered to be cost elements only in an effectiveness/cost analysis that regards the government or a particular government agency as the unit of analysis and that seeks to maximize the effectiveness of that agency without regard to the effect upon the rest of society. Most economists would seriously question the relevance of such an application of effectiveness/cost analysis.

Concept of Private Cost. The private cost of training does not include the trainee's share of the government cost of instruction, since the trainee would be sacrificing the same amount of resources for instruction regardless of whether he enrolled. For the same reason, it would not include his share of the government administrative costs. Furthermore, it would exclude those training-related expenditures for which he would be compensated by the government. In contrast, the loss of unemployment benefits and welfare assistance and the increase in tax payments, which he may experience as a result of training, may be regarded as an element of private cost. (Alternatively, the loss of benefits and the increase in tax payments may be regarded as outcome variables, and in a benefit/cost analysis, they may be regarded as negative benefits. The choice among these views is usually immaterial; the important thing is to count these items once and only once.)

The Effectiveness/Cost Ratio

The end product of an effectiveness/cost analysis is a statement on the effect that a particular activity has on selected output variables and on the cost of the same activity. The statement may be of the simple form of a ratio or one of so much effect and so much cost. Alternatively, it may express the effect as a particular function of the total cost of the activity and of any conditioning additional variables.

Benefit/Cost Analysis

If the output variables are measured in monetary terms and if the value of these outputs is compared with the monetary costs of the activity, the effectiveness/cost analysis becomes a benefit/cost analysis. The operations required be an effectiveness/cost analysis are thus also required by the benefit/cost analysis. The essential technical difference is that in the latter analysis, the output and cost variables are expressed in a common denominator and the aggregate benefits are compared with the aggregate costs.

Benefit/cost analysis is more controversial than effectiveness/cost analysis because there is only limited consensus as to the proper valuation of the outputs of training. The following statement is restricted to the situation of a social benefit/cost analysis in which it is agreed that contribution to national product is the one proper basis of valuation.

Effect on Earnings versus Effect on National Product

The increase in earnings that trainees obtain as a result of training roughly represents the direct contribution that training makes to national product. Many indirect contributions have been recognized: The savings in administrative and correctional resources that results from the reduction in dependency and delinquency that training may bring about, the reduced placement effort required in the public employment service because of the increased employment stability of the trainees, and similar factors. These additional benefits should in principle be included with the increase in earnings. However, at our present state of knowledge, they are not easily measurable and are, therefore, often either considered only impressionistically or else disregarded in the overall evaluation.

Choice of Social Rate of Discount

Both the costs of training in terms of foregone earnings and the benefits of training usually occur over a period of several years. The benefits as well as the costs must, therefore, be converted to apply to a particular point of time, usually the date of decision or the present. The converted values are called the present value of benefits and the present value of costs. Conversion is accomplished by discounting the benefits and the costs back of the selected point of time with a chosen rate of discount and by summing up the discounted benefits and the discounted costs. The rate of return that society as a whole receives, in terms of national product, on available alternative investments, whether in the public or the private sector of the economy, is the appropriate social rate of discount. The social rate of discount is not in general equal to the interest rate that government pays on bonds it sells to the public.

Present Value Formulas

Formulas for expeditiously calculating present value may be found in any satisfactory text on finance mathematics. In general, the present value of benefits equals:

$$PV(B) = \frac{B_1}{1+i} + \frac{B_2}{(1+i)^2} + \ldots + \frac{B_t}{(1+i)^t} + \ldots + \frac{B_T}{(1+i)^T}$$

and the present value of costs equals:

$$PV(C) = \frac{C_1}{1+i} + \frac{C_2}{(1+i)^2} + \ldots + \frac{C_t}{(1+i)^t} + \ldots + \frac{C_T}{(1+i)^T}$$

where i = the discount rate as a decimal fraction, t = the particular year, T = expected life of the combined benefit stream and cost stream, B_t = benefits in year t, and C_t = costs in year t.

The Benefit/Cost Ratio

The benefit/cost ratio equals the present value of benefits divided by the present value of costs, that is:

$$B/C = PV(B)/PV(C)$$

Given the methodology and other assumptions and limitations, whenever benefit/cost ratio exceeds unity, the corresponding activity is economically superior to the alternative activity with a lower benefit/cost ratio.

Time Profiles of Benefits and Costs

At the present time, there is little agreement on the numerical value of the social rate of discount. Values ranging from 4 to 10 percent have been suggested. The values of the benefit/cost ratios are strongly affected by the choice of discount rate. The analytical results become more useful, therefore, if they are presented in such a form that any decision-maker can recalculate the present values and the benefit/cost ratios in accordance with the discount rate that he regards as appropriate. It is therefore recommended that the analyst should publish the data on the behavior of the benefits and costs over time and not merely present single benefit/cost ratios.

Using the Benefit/Cost Ratio

If purely economic efficiency criteria are to be used in determining the investment decision, one should first choose the projects having the highest benefit/cost ratios and should not undertake projects having benefit/cost ratios below unity. How far down one should go among benefit/cost ratios exceeding unity depends on how many investment resources are available.

Naturally, however, the decision-maker may decide that additional criteria, perhaps of a noneconomic nature, may also be applied to the decision. The desire to provide vocational education for particular population groups might be a reason to deviate from the recommendations given by the narrowly economic benefit/cost ratios.

Chapter 20

MANPOWER DEMAND AND SUPPLY

Introduction

The economic analysis of manpower supply and demand, including projections and their validity, is of great importance to vocational educators. A basic requirement of effective planning is that it proceed from established and accepted planning premises. The factors that bear most critically on occupational education include the interests of and choice exercised by the students; the manpower requirements of business, government and industry; the existing supply of manpower and its characteristics; and the political and legislative environment, including legislative and financial constraints, in which the school systems operate. The current and prospective economic environment introduces significant considerations. The growth, stability, or decline of particular industries has direct effect on the demand and supply of manpower, both in overall terms and with respect to particular jobs or job clusters.

Much attention is given to the measurement and interpretation of job vacancies. The National Bureau of Economic Research recently concluded a conference on the subject.[25] The President's Committee on Manpower has also completed a study of concepts and methodologies, described in this volume. A brief survey and proposal for long range forecasting of occupational job requirements is included in a recent issue of "Employment Service Review."[26] All of these studies, while indicating that progress is being made, identify many deficiencies and shortcomings in manpower forecasting. Job vacancy data serve several purposes, including: (1) counseling and referral, (2) training, (3) placement, (4) indicators of trends in the economy, and (5) facilitating labor market supply-demand comparisons either on an overall basis or by an occupation, by area, or by occupation and area.

To serve current placement purposes, there may be sufficient data on desired worker characteristics, such as education and experience, and specific job information with respect to content, wages, working conditions, and duration of employment. For training purposes, however, the educator also must be concerned with trends in employment, by occupational categories, and by job families. The vocational educator also must know the relationship between job vacancies as forecast for the future and the inventory of the existing work force and manpower qualifications and characteristics to meet that demand. He must further know the wage rates offered.

Survey Findings

This type of economic analysis has had a longer history of application to the problems of the educator than that of benefit/cost analyses. The reconnaissance survey found that although many surveys of demand were being conducted by the employment service, labor departments, and advisory committees to the vocational educators in the states and communities, there are many deficiencies that need to be corrected. Area skill surveys, although useful, are not conducted with adequate coverage of a sufficient number of states or of the major metropolitan areas. They are not kept current, and they do not project far enough into the future. They do not provide vocational educators with the information they require about job clusters; job specifications; and the knowledge, skill abilities, and other qualifications required of incumbents. Surveys conducted by advisory committees to vocational educators lack sophistication of methodology, but in the absence of better data, they have varying degrees of usefulness to vocational educators in different jurisdictions. The needs of local manpower trainers and vocational educators responsible for decisions on course offerings and curriculum development are not now being satisfied by the economists making labor market projections. Adequate data on the supply of manpower and its characteristics to meet demand are not now available. There is a requirement to coordinate activities on federal, state, and local levels more effectively between the educators and those conducting the economic analyses. The joint agreements between departments of labor and education at national and state levels require joint concepts, methodology, work programs with established priorities, and shared funding arrangements for more rapid and effective progress.

The summary of the reconnaissance surveys is followed by Thayne Robson's paper describing the findings and recommendations of the Committee on Manpower Projections. This committee was established under the President's Committee on Manpower to appraise projection work being done in this area by the several federal agencies. He reports that "our data on a national level are much better than data on a state level, and yet educational planning takes place primarily at the state and local level . . . at the state and local level we are still woefully short of having the kind of data necessary." He makes a strong plea for model building to force planners and administrators to focus on data gaps and relevant factors.

The Norman Medvin paper reinforces the general findings that state and local projections are in need of substantial improvement. He reviews current methodology being used at federal, state, and local levels and describes an interesting new approach being tried out in Milwaukee. He focuses on the myth that newly emerging occupations are rapidly changing the occupational structure of the world of work and asserts that "the job structure changes rather slowly." He challenges the notion that precision is needed in job forecasting and advocates a new approach using the Department of Labor's Occupational Outlook Handbook and the Employment Service Unfilled Job Openings as the basis components used in structuring the suggested methodology. He describes the application of the new technique in Milwaukee. There is abundant evidence that innovative new approaches are badly needed in this area, as well as improvement of existing techniques. Although initial reaction to the approach as tried in Milwaukee is favorable, validation techniques over a longer time exposure is required before final evaluation of its worth.

The Leonard Lecht paper sets forth an overview of national trends in manpower to meet national goals in the 1970s. The manpower forecasts are set forth in broad classifications related to projected dollar expenditures and national objectives with some adjustments. Although useful in setting forth national trends in the economy and related manpower, the data can be of only limited value to the educational decision-maker at the state and local level. Its chief value is in setting forth the broad environmental considerations that impinge on the planning process.

Current Policies and Practices in Manpower Programming

Area Skill Surveys

The state plans include agreements under PL 88-210 between the departments of labor and the boards of education for cooperative activities that require the U.S. Department of Labor to "conduct surveys to determine area and state employment needs." The state departments of education agree to "utilize the information provided by the state departments of labor as a basis for the development of new vocational programs, modification of existing programs, and curricular changes."

The area skill surveys are designed to provide the educators with this essential information. The U.S. Department of Labor's Area Skill Survey describes the need for occupational job market information and methodologies used.[27] The local chambers of commerce and the manufacturer's associations participate with the labor departments in these studies. Projections are usually limited to two years into the future, although some are for five years. Many studies have been made throughout the country over the last several years and are published with titles such as "Jobs for Tomorrow," "Skills for the Future," and Jobs for the Future." Despite the emphasis on the "future" in the monograph titles, projections frequently are limited to two years or less. For example, a study for Bridgeport, Connecticut, was conducted in 1965 and published in January 1966. It showed needs to June 1967--an actual projection of 18 months.

Some training programs initiated in 1966 will require two or three years and will be completed in 1968 or 1969. Students are being trained for a lifetime of work in an environment where jobs are predicted to change much more rapidly in the future than in the past. Vocational educators need a lead time to develop their program courses, and students need a lead time to register. The effective projection of some area skill surveys may, therefore, be less than a year. Representatives of the state labor departments and the state vocational education boards both stress the desirability of having a five-year forecast. The handbook referred to above indicates the desirability of projecting two to five years into the future. Projections for two years rapidly become obsolete, despite the recognized need to keep them current. A general complaint of state employment services personnel indicated that they did not have enough funds to maintain surveys on a current basis. In addition to the criticisms that funds were lacking and that projections were for too short a period, educators stated that only job titles by industry were used and that there was insufficient information on job specifications and required worker characteristics and qualifications. In some states, little use is made of the area skill surveys by vocational educators. In one state, no study had been conducted since 1963, and some area skill surveys had not been updated since 1959, despite the fact that projections were usually for short time frames.

The director of research for one state employment service was asked why the projections were not made for five years in view of the clear requirement for projections longer than a year or two. He indicated that funds and qualified staff were lacking. An additional major reason he gave was that the further you project, the more uncertain the projections are. He cited one five-year forecast for a major labor market area that he had made in 1956 that was subsequently made to look "foolish" due to the recession in 1957-58. A similar hazard was cited by the interviewees in the employment service of another state who said that a ten-year projection, a long time in development, was vitiated shortly after release when a major airplane manufacturer had a very substantial contract cancellation. One of these gentlemen had a lot of explaining to do before the state legislature, and indicated he did not intend to get caught in that situation again. He expressed the view that there had to be a breakthrough in the technology of forecasting before forecasts of longer range than two years could be useful.

There was also some resentment expressed by state employment service personnel that the vocational educators have sufficient funds under the Vocational Education Act of 1963 that they use to conduct their own surveys and to let contracts with universities and others. They expressed a strong feeling that since a certain amount of competency was necessary to do job vacancy surveys, more funds for this purpose should be made available to the state employment services from the vocational educators.

A manpower economist with the U.S. Employment Service expresses the foregoing attitudes as follows:

> A note of urgency compounds the situation. The Vocational Education Act of 1963, in allocating hundreds of millions of dollars for vocational training, specifically gives a mandate to the Employment Service system to provide job market information to the vocational school system. The State Employment Services, with no additional funding and with the traditional and costly skill survey technique available to them, have in many instances been unable to furnish the information which by law they are obligated to provide.

> There have been a number of instances in which the state vocational education people have attempted to get the information themselves, or have financed private consultants or universities to obtain the information for them. It is clearly paradoxical that the employment service with the most knowhow in the manpower field frequently finds itself sitting on the sidelines while money is being distributed to others with far less experience to do the job . . .[26, pp.63-4]

Other Surveys

Many surveys are conducted by vocational educators in each of the states through the use of craft advisory committees or advisory committees for a particular occupational category or specialty. These vary in practice from formally structured surveys to rather quick assessments conducted by asking employers to state the job vacancies they currently have by job title. They rely on the data submitted by the particular individual in the company contacted. This may be a personnel man in one company, a chief executive in another, and an operating official in a third. The basic concept and methodology used by the companies in making their projections are neither stated nor requested. An employer who might wish to ensure a large pool of workers available to him in certain occupational specialties could exaggerate his requirements, since little conceptual rigor is introduced into these assessments. Most survey reports of this kind identified immediate needs only. In the absence of better methodology and data, these ad hoc surveys do identify job resources and training requirements and in a limited way fulfill an important function.

Even when a survey determines that there is a critical requirement, there may be barriers to responsive action to satisfy the demand. One state identified substantial continuing demand for health workers but could not get a sufficient number of persons interested in undertaking training to fill them because the wages paid were too low. State and local representatives indicated that operators of nursing homes and other medical institutions say they cannot afford to pay higher wages. Job seekers indicated they could earn more money in other occupations and exercised preferences accordingly. Vocational educators showed an awareness of this kind of situation but were not sure of the appropriate course of action for its solution. Should the educational institutions and the state employment services recruit and train workers for services that pay wages that are too low in relation to other jobs in that particular labor market? This could represent a subsidy to the employer. Should the vocational educators completely disregard this important question, as well as the fact that any overt action on their part could worsen the situation by increasing the pool of trained persons?

An opposite situation is reflected in some craft unions' efforts to restrict the supply of labor and thus permit them to keep wages high. Job opportunities exist in these areas if the artificial restrictions could be overcome.

A survey in one state showed a need for 769 technicians, annually projected through 1973.[28] The need could only partially be met by state technical institutes and private schools, with an annual deficit of 140 technicians shown. This kind of data is very useful for the development of programs with goals and time-phased resource requirements to obtain the particular technicians required.

The survey of technicians noted that not all applicants for training are registered and accepted. Some are not qualified, and capacity is not large enough to accept them--even if all were qualified. The number who did not attend after acceptance and registration was substantial, despite the shortage of technicians in the state. This raises serious questions for programming. Capacity that was set aside for these trainees may remain unused.

Although this was a useful survey, it is interesting that on-the-job training of technicians was deliberately excluded from it. In addition, although there is immigration of technicians from other nearby states, the data did not reflect true net demand. The annual requirements for each of the ten years were not time-phased, nor was there an indication that any study had been made of alternative courses of action to satisfy the demand, such as increased on-the-job training.

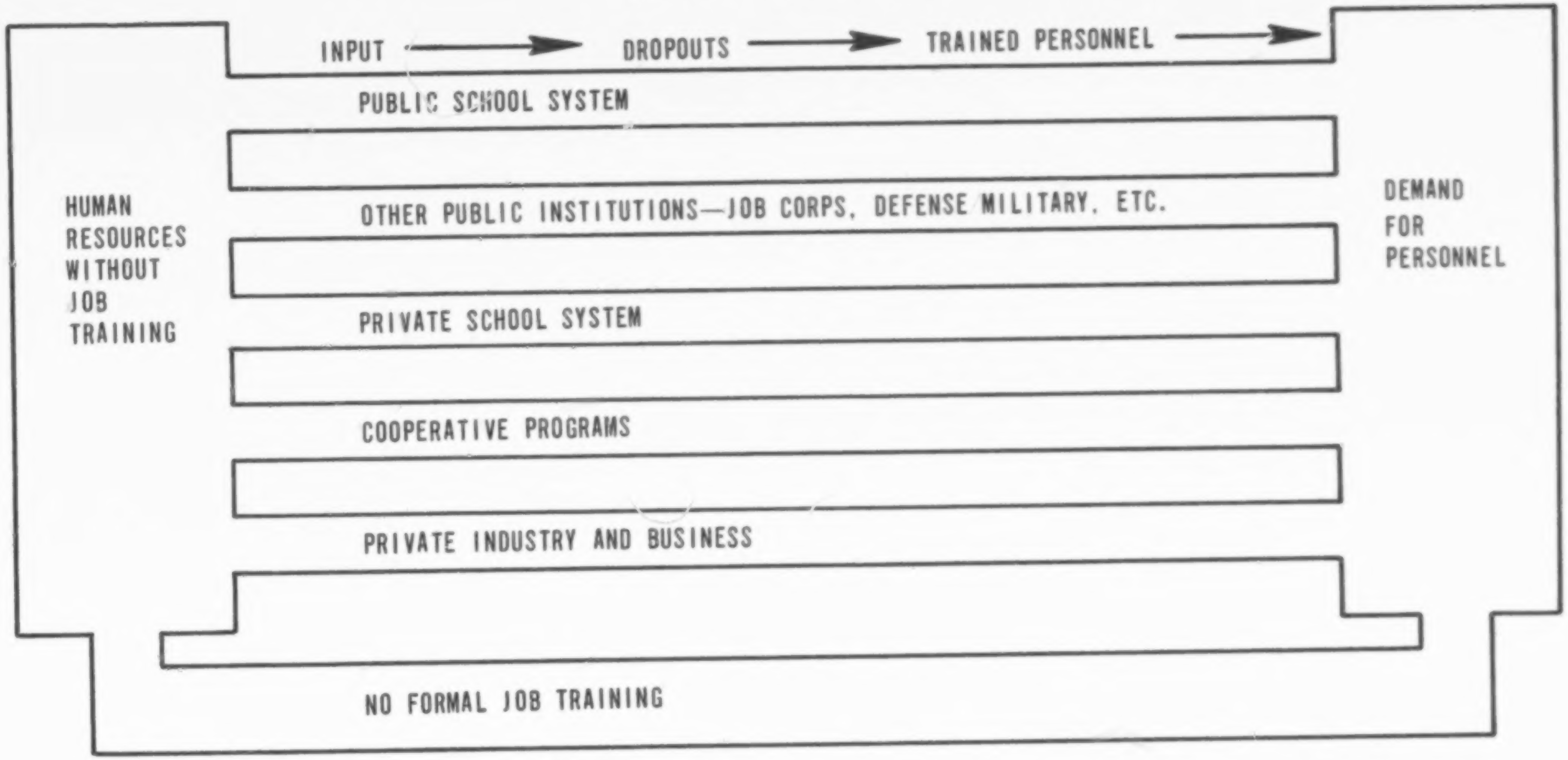
Other alternatives would consider the trade-offs in: (1) providing a wide range of course offerings to meet student interest without concern for balancing enrollments and graduates in relation to job demand, (2) carefully measuring demand and planning course offerings to balance demand, and (3) combining the first two alternatives, so that job demand estimates are not required to be quite so accurate and programming considers forecast demand as only one among several factors.

Actual programming in vocational education appears to be accomplished in the manner of alternative 3 above. Programming proceeds from the historical base with adjustments made in terms of surveys of demand, student and faculty interest, pressure from advisory committees, and the like.

One argument presented for using alternative 3 is that in a democratic society the individual should be able to follow a career of his own choosing. A wide range of course offerings should be made available to the students under this concept. Demand would be one factor, but not the important one, in structuring course offerings. This proposition suggests that supply creates its own demand, in that the employer does have some discretion to adjust his job specifications to the qualifications and characteristics of the available work force. However, failure to recognize a declining industry or obsolete skill could result in wasted training for a good number of students.

Figure V-5 illustrates the kind of information required by manpower officials to facilitate more logical planning with respect to the demand for and the supply of personnel. The supply pipeline assumes a given level of aggregate demand and a given wage level being offered

FIGURE V-5
THE DEMAND FOR AND SUPPLY OF PERSONNEL
SUPPLY PIPE LINES


INPUT
DROPOUTS
TRAINED PERSONNEL
HUMAN RESOURCES WITHOUT JOB TRAINING
PUBLIC SCHOOL SYSTEM
OTHER PUBLIC INSTITUTIONS—JOB CORPS, DEFENSE MILITARY, ETC.
PRIVATE SCHOOL SYSTEM
COOPERATIVE PROGRAMS
PRIVATE INDUSTRY AND BUSINESS
NO FORMAL JOB TRAINING
DEMAND FOR PERSONNEL

to attract students into the training system. It would be important to know the number of inputs, dropouts, and graduates for a particular state or community by occupational categories and job clusters and for each of the pipelines indicated on the chart. A well-known study reported that more than half of the work force had received no formal occupational training or specialized education for the jobs they occupy. The report stated:

> Another reflection of the widespread use of training is the fact that 30% of all workers said that they had relied on formal training as one means of learning their jobs, even though, as previously indicated, a majority of the workers had received no training. Over half, however, reported that they had learned on the job through informal means, and 45% reported they had learned their job from a friend or relative or 'just picked it up.'[29]

Some states had carefully structured lists of private schools and exerted some supervision over the quality of training in some occupational specialities. For example, cosmetology is taught by both public institutions and proprietary institutions in one state. Costs for training in proprietary schools may range from $400 to $1,000. Tuition is free to the student in the public institutions, although obviously he bears other opportunity costs and social costs. Some pressures were at times brought on the vocational people by the proprietary schools charging unfair competition. However, the placement rate from both public schools and the propriety schools is very high, although the reason is due to a high turnover rate among these workers.

Private industry and business is another pipeline indicated on the chart. Substantial training programs on the job are conducted by employers such as General Motors, Chrysler, and United Aircraft. In one state, two major companies conduct large training programs. It is interesting to note that while one will accept no help in training employees on the job from the U.S. Employment Service or vocational educators, the other is assisted by USES and vocational educators. The preponderant bulk of work by these companies is performed for the Department of Defense.

Further Research

No studies are made of total supply coming out of the pipelines--proprietary, religious schools, manpower development and training, and on-the-job training--nor is any responsibility assigned or recognized for such summation and evaluation of total supply as related to demand. No comparative benefit/cost or effectiveness/cost analyses are conducted, nor is the responsibility or desirability for them assigned, assumed, or recognized.

The forecast of demand is one of the prime factors for consideration in planning program offerings and setting priorities among offerings. in relation to the objectives of education. As indicated above, many significant problems that represent formidable barriers exist and have been recognized. The number of qualified persons able to focus sharply on this problem is limited. Resources and efforts of the agencies primarily concerned with this area appear to require better direction and coordination than is now the case.

Today, the technology to accommodate a national job vacancy reporting system is at hand. All that is needed are the data inputs. Daily, within many locations in every major city of the country, stock market transactions are flashed within minutes of the transactions for each of 2,200 stocks that appear on the American and New York stock exchanges. A similar reporting system for unfilled vacancies in every SMSA could be placed in operation. Of course, judgments would have to be made on whether to limit the inputs to those that have been unfilled for 15 or 30 days or longer periods. This would then facilitate a better matching of jobs with people seeking employment. The information could be transmitted instantaneously from one central place to all participating employment offices.

Similar arrangements could be made for a state or region whereby the number of days for reporting unfilled vacancies is reduced from the criterion set for the national system. The costs for operating the system might be paid for by drawing on funds for the administration of the unemployment insurance system. If the system worked effectively, it would reduce the payout of unemployment insurance and might provide benefits in excess of its costs.

Job Vacancies and Economic Growth. There is no attempt to try to identify whether certain specified job vacancies or worker shortages create barriers to economic growth and development. It is possible that some key jobs in strategic parts of the economy and the availability of qualified applicants to fill them may have greater impact on the economy and be more important than others. There may be secondary affects on productivity as some key jobs are filled. No studies have been made of this area.

Determination of Supply. No systematic inventory of supply is conducted. When the area skill surveys are made, each reporting establishment identifies the number of workers in each occupational specialty. There is also an indication of the number needed for expansion purposes and the number needed for replacement. As in the technician training projections described, there is an indication of whether training is in the public schools or in the proprietary schools. In some instances, perhaps some on-the-job training is shown, although in the technical training survey mentioned above this was specifically excluded by design. The number of people reported in an occupation does not necessarily represent the full supply of this skill. There may be other people either underemployed in other jobs with different titles or fully employed in entirely different occupations who might represent part of the supply for a particular occupational family. If proper studies were conducted of job specifications and worker characteristics, it is quite possible that the skills of the current work force would provide some portion of the additional supply of qualified workers through transfers, promotions, and upgrading actions. Although this could contribute to turnover rates in the short run, it would open up more jobs farther down the career ladder for those with less training or skills. None of these possibilities have really been explored in terms of an inventory of supply of trained workers. It appears that substantial additional research work would be useful here.

Chapter 21

EVALUATION OF SUPPLY-DEMAND PROJECTIONS, CONCEPTS, AND TECHNIQUES

By

Thayne Robson

I would like to summarize the report and recommendations of the Committee on Manpower Projections established under the President's Committee on Manpower.

This group was established out of the realization that a wide variety of manpower projection work is undertaken by different federal agencies and departments for a wide variety of purposes, and somebody, at sometime, should appraise the adequacy and quality of the work being performed and make recommendations concerning the things that should be done to improve the quality of our work at the federal level. The task force invited those who make manpower projections to appear before it and answer the following questions:

1. What determines the time horizon of the projection?

2. What determines the level of aggregation of the projection?

3. What explicit assumptions are made about the general social and economic environment? What other assumptions are made?

4. To what extent are alternative projections provided?

5. What technique is used in arriving at the projected figures?

6. What qualifications and implications for the projections stem from the use of particular techniques?

7. What data inputs are used to establish the relationship used in applying any given technique?

8. What policy recommendations, if any, flow from the projections? What specific uses are made of these projections by your agency and by others?

9. What experience can you report on the reliability of past estimates in using these projections?

10. What are the major shortcomings of the projections? What suggestions are there for the use of other techniques or for the development of additional or more appropriate data inputs?

I think you would not be surprised at the first conclusion, which was that the questions directed to the forecasters were more sophisticated than the work of the forecasters.

The Committee identified a number of specific types of projections being made by different agencies in the federal government. There are projections on occupational requirements, labor supply, school enrollment, local area manpower requirements, economic growth, agriculture, manpower, health, and a variety of other occupational groups. The task force finally came to the conclusion that the term "manpower projections" could be broadly used to include three types of forecasts: (1) broad projections of manpower supply, which are basically related to population estimates by age and sex; (2) projections of manpower requirements or demand based on projections of economic activity; and (3) detailed projections of supply or demand of specific occupations that may be fitted into the overall models or may be developed quite independently. For some immediate program purposes, such as planning training needs or estimating the constraints that manpower shortages may impose on a specific program, projections may be short term--for two or three years. For most purposes, the projections are for a longer term, usually ten years or so. Projections longer than a decade are not usually attempted, except in very gross terms.

The first recommendation of the task force is to alert the government to emerging manpower problems in terms of balancing supply and demand for the labor force. To do this, it should maintain full employment levels of aggregate economic activity. Second, government agencies should develop guidelines to help choose between alternative proposed policies. Third, these agencies should select the most effective projections to assist in administering specific government programs like the Vocational Education Act and its various programs. Fourth, guidelines should be established to provide for development of other general types of projections by government and private organizations so that manpower projections really become effective inputs to the possible range of models and projections that may be needed. Fifth, the task force recommended the provision of information for vocational guidance of young people, and sixth, the task force recommended a greater effort to encourage and inform a responsible public of the concern for manpower problems. The task force thought these were the major uses to which our projections are being put, and, of course, the kind of projections needed for each of those uses will vary in terms of the use to which the projection is to be put. One thing of great concern is the possible improper uses to which projections are put. One in the policy arena in Washington is constantly running into Congressmen or people on the Hill who say, "Did you know that by 198-, this was going to happen," and you are forced to say, "No, I didn't know that was going to happen, how do you know it is going to happen?" To which they reply, "We have here a study or projection prepared by Dr. so and so, and such and such Institute, which simply shows that if we train everybody in the United States to enter our profession, we will still have a shortage in the total supply."

Projections are put to a variety of uses and abuses that, unfortunately, the people who make projections cannot control. It would be instructive for all of us if a paper were written on how the distinguished work that has been done has been abused by people who have used the projections for purposes entirely different from those for which they were prepared.

The recommendations of the task force in dealing with the manpower projection work of the federal government were that much of the work we need to do needs to be considerably more sophisticated and this relates to the kinds of techniques and methodologies we use from the kinds of simple projections. For example, we noted that the committee of physicians, called together to make some determination of how many doctors we should have in the country in 1980, decided simply that the ratio of doctors to some unit of population in 1959 was the appropriate measure and that we needed X number of physicians for Y number of people. In essence, the doctors simply made a normative judgment. This is the kind of normative projection that is not an attempt to define what will happen but what should happen. The conclusion of such professional associations is that we must train more people. They feel that this is the strongest case they can make for additional federal resources to support training. I think projections of this type are helpful but not so good as they should be. They highlight normative manpower problems but they fail to take into account those things on which the fulfillment of these normative projections depend: changes in technology; changes in level of overall economic activity, as well as the demand for their particular service; and the rest of the variables that a group like this should consider in terms of what might influence the refinements of skills and development of subprofessionals.

These normative projections are to be contrasted with projections that are an attempt to forecast what actually will happen. For example, with respect to doctors, one cannot ascertain how many doctors we should have to accomplish the basic goal of medical service, but we are given an intermediate stated goal in terms of some desired doctor-patient ratios. We can do this in education and any of the occupations. It works best for those occupations where entry is restricted by license or state certificates, since then you have a method of controlling the total supply. However, the achievement of this given doctor-patient ratio does not necessarily mean that the broader goals of medical service will be met. Different measures of the goal achievement of the medical needs of our society would likely result in entirely different forecasts of demand for doctors.

The development of the aggregate economic models, either using the interindustry techniques or the techniques of the National Planning Association, is another area that needs more development. The NPA is developing an aggregate model of future manpower requirements based on expenditure patterns in the U.S. economy. Most people would agree that such aggregate models hold out the opportunity for being most useful to us in the future. These forecasting models point out that if you are going to have more of some people in one occupation, given the parameters of the labor force and a clear perspective of the alternatives in the economy as a whole, it means less people in other occupations, and you get a more balanced view of the interdependent structure of the labor force. Our major problem, of course, is the problem of data, i.e., having adequate information with which to develop employment data by occupation with sufficient refinement so that we can come up with the aggregate model.

The Committee also suggested that, on the methodological questions, it is important to work toward the more explicit assumptions. For example, a projection by one of the federal agencies said: "It is assumed that economic and social patterns will be about the same in 1970 as today." That was an assumption on which a projection was made. What it really means is not at all clear. Is it always the case that the future will be like the present and the past? Is such an assumption meaningful in a study projecting demand for ten years, for instance?

The Committee also reached the conclusion that more attention must be paid to the conceptual framework on which projections are formed. Work on more formal mathematical models should be expanded to assist in assessing the conceptual framework used in more largely judgmental models. This effort should point the way to gaps in theory or information. On some of the model building problems, the Committee concluded that detailed projections should be tied in with overall economic models, since projections do not exist in isolation from total models of economic activity in the community. This fact is very obvious, and such work has been done at the federal level. But when you get down to the state and local level where we are planning and operating manpower programs, you frequently get into the kind of situation where, for example, a mayor's city planners have a model that says employment in this city is going to grow by X percent. Then, when you talk to the people in the education and manpower field, they specify training needs for people in occupations that bear no relationship to the economic model within which the broader planning is supposed to be taking place in the community.

One of the major problems is that our data on a national level are much better than data on the state or local level, and yet educational planning takes place primarily at the state and local level. We are still primitive in our manpower projections work, even though great pioneering work has been done in the Bureau of Labor Statistics. We have never really been able to explore through research the implications of our assumptions. We have projections now that were made in the last three to four years and that were based on the assumption that military expenditures and manpower requirements would not change radically, but such is not the case. There have been major changes in the base of these forecasts. Thus, there should be requirements to update forecasts at least every six months to accommodate changes in defense and the level of economic activity, at least for the national projections.

At the state and local level, we are still woefully short of having the kind of data that is necessary. One goes into a city to develop manpower and training solutions to reduce unemployment in the slum areas. This ought to be done within any particular city in terms of the basic conceptions on how that city or SMSA stands in relationship to the labor requirements of the economy as a whole, but there is no city in which we are operating where there is an adequate data base for administrators to relate manpower and poverty programs directed to the different individual needs of people to the emerging opportunities in that community. In the absence of those data, most communities have to plan in terms of national requirements rather than local or state requirements, though the area skill surveys do provide some guidelines and some special studies are being undertaken. One matter that poses the greatest problem for educational planning today is that the data that are collected and fed to state legislatures, governors, and decision-makers are at a very low level of sophistication.

In conclusion, if we are to do an adequate planning job, we must improve the quality of our manpower projections at the level where educational planning is done--at the state and local levels. If you ask if our manpower projections and data have kept abreast of our policies to alter the less desirable outcomes of the economic system, I think it can be said that we are not doing this and that we are overlooking, in educational planning, the development of the kinds of data on which sound planning can be based.

Discussion

Mr. Swerdloff:

Perhaps a good way to begin this discussion is to ask the question, "Why bother to plan education for employment needs at all? Haven't we done well enough without it?" Concern about planning education to meet the economy's needs for specially trained workers is a relatively recent phenomenon. The concern stems from the increasing pace of technological and social changes that are giving rise to rapid changes in requirements for certain occupational skills. In addition, the growing complexity of technology and of industry may be resulting in an increase in the degree of occupational specialization and may require more extensive special training. Perhaps more important is the increasing assumption of responsibility for vocationally oriented education and training by centralized agencies of government. These agencies are able to see the training problem as a whole and have some obligation to do so to allocate public funds wisely.

How harmful has been the past lack of educational training for manpower needs? It might be argued that this has resulted in shortages in some occupations and an overtraining in some of the traditional fields of vocational education. These errors have not resulted in as severe manpower crises as they might have, because of a number of factors. One has been the flexibility of workers--especially those with broadly based general education--who have been able to adapt themselves to new work demands. Another reason is due to the flexibility of industry in rearranging work to use less highly trained workers. Individual flexibility may be seen in the significant proportion of the members of nearly every occupation who have been able to enter the field without formal training. As Garth Mangum points out in his paper, "Only three out of ten of the current noncollege trained labor force have any formal training for their jobs." And only part of these received their formal training in school. Another example of flexibility is the considerable degree of occupational mobility. Even in scientific fields, which we think of as requiring the highest degree of specialized training, occupational mobility is significant. The flexibility of management may be seen in many situations of occupational shortages: the use of scarce skilled machinists to set up the work in machine shops so that it can be done by semiskilled or unskilled machine operators; the use of technicians to support, and partially supplant, fully trained engineers or scientists; and the use of hospital attendants or practical nurses to take over some of the routine tasks from the professional nurses.

Thus far, we have apparently done well without having educational planning related to manpower requirements. But we must recognize that this necessary mode of adaptation is not without its cost. The economic costs are obvious; for example, in the short run, using less skilled workers may reduce productivity and slow economic growth. The individual loses income if he lacks the training needed for skilled work. Also, there may be a higher rate of frictional unemployment. Less obvious are the costs in terms of the quality of life in a society dependent on inadequately trained nurses or shortages of physicians or the shortage of well-trained appliance or automobile repairers.

Thus, in an attempt to reduce this dependence on improvisation and adaptability, society is trying to plan education and training to meet changing manpower needs. Any steps that can be made, however modest in reducing the probability of occupational shortages or of having more specific training for skills, would reduce the cost noted previously.

I need not spend any time on the evaluation of supply-demand projections concepts and techniques. However, I will say that projections are being made in specific occupational and industrial detail for 10 to 15 years in the future, and we have some reason to believe that they are of adequate accuracy for many educational planning purposes.

Assuming that manpower needs can be projected, what can we say about whether the enterprise is worth the effort? In the absence of systematic projections, we have nothing to go on but past patterns of education--and, in a rapidly changing society, this is found to be the wrong way to go about it. It is not necessarily true that because we have had so many classes of machine shops or woodworking in the past, we should continue to have them. Projections that have even a modest degree of accuracy are better than none at all.

The case of considering projected manpower needs in educational planning has to be made with some diffidence but the case against such projections is clearly indefensible. Some projection, implicit or explicit, lies at the base of any long term plan.

There are a variety of approaches to educational planning, depending on one's social philosophy. To oversimplify, I will suggest a few typical viewpoints. At one extreme are those who view education in its broadest function as humanistic in purpose and designed to prepare youth for the full life. This view tends to develop plans for education in terms of the demand generated by the growth of population and the social trends affecting the desire for schooling of various groups of the population. Those holding this view of educational goals are often suspicious of the heavy hand of the state, planning the life of the individual to meet economic needs. Also, they distrust our ability to anticipate these needs. They are willing to leave the articulation of economic needs and education to individual adaptation based on a broad educational preparation.

A second point of view, closely related to the above, is that, while education must be articulated with the manpower needs of society, this should be done indirectly through the market mechanism, i.e., let the decisions of young people be determined by the relative attractiveness of various occupations (in terms of wages and working conditions), as well as their own preferences for different types of work. The function of planning is to anticipate these decisions and to provide students with the courses or training they want. Proponents of this viewpoint would also provide students with information on employment opportunities and with vocational guidance services to help them choose. This approach preserves the freedom of individual choice and depends on the play of the competitive market to determine the allocation of individuals to occupations.

Third, while we hesitate, in an open society, to put social constraints on the individual's freedom of choice, the students themselves, unsure of their own ability to make sound decisions, often seek guidance. It is the common experience of vocational counselors that they have to carefully avoid making the decisions for some clients.

These practices arise because of the practical realities of the educational structure and of economic life. A nation's ability to relate the number of students trained for each occupation to the manpower needs depends on the manner in which the educational system is organized. Highly centralized national control of educational institutions makes it possible to make and implement decisions as to the number of places to be provided in each course or type of institution. But what can be done in a country where privately controlled schools make their own decisions as to expansion of facilities and enrollments or where state or local educational systems have a jealously guarded autonomy?

Even in these circumstances, there is an area of responsibility for the national authorities. At a minimum, they are called on to develop projections of manpower needs and data on the output of the various institutions and to compare the two to evaluate the extent to which the decentralized system is meeting the needs. By publicizing its findings, the national authority can call attention to emerging problems and by providing leadership, encouragement, and exhortation can hope to persuade private and local officials to adjust their programs. Precision in the response of a pluralistic system such as ours to meeting numerically quantified needs is too much to expect, but we can at least hope for a movement in the right direction once the light is shown.

Part of the problem is one of how to organize the decision-making activities of independent institutions to achieve a common end. By what process, for example, does the administration of a private or state university decide what it should do about a study that has been made showing that the nation must expand its annual output of engineers by, say, 30 percent? Short of each institution expanding its enrollments and facilities by the same percentage--which is highly unlikely to happen--by what mechanism can an orderly and appropriate adjustment be made? Mechanisms for mutual consultation may prove helpful, under either government or private auspices. Organizations such as professional or educational societies can give leadership and provide a forum for discussion and reporting of plans or decisions.

Going beyond the establishment of numerical goals by means of manpower requirements projections, leadership, and exhortation, the national authorities have a few other devices they can use. Provision of financial aids to students or institutions is one such method. We have developed this approach in a variety of ways: the National Defense Education Act to promote training in such subjects as modern languages and vocational guidance, fellowships in science administered through the National Science Foundation, grants and loans for the expansion of medical education, fellowships in psychology financed by the Veterans

Administration, and many others. These forms of intervention are relatively new, and it is still too early to tell how well they work. Such evaluations will be possible as manpower requirements projections are more regularly promulgated over the next few years and are compared with data on the numbers of graduates in each field.

So far we have discussed only the nationwide planning of education in relation to manpower needs. Local planning introduces another problem dimension. To the extent that a nation's manpower supply and demand are self-contained (i.e., the immigration and emigration of trained workers is either negligible or capable of being taken account of in the projections) a national system of projections can be useful in national educational and training efforts. But local educational planning is complicated by internal migration. This migration can be considerable. In the United States, for example, nearly two out of five 18-year olds in 1955 had moved to a different community five years later, and half of these movers had gone to a different state. Looking at the data another way, nearly half the men in their 40s were living in a community other than the one in which they attended secondary school. Thus, the school system of any community produces workers for other communities. Migration is more prevalent among professional workers, who typically make their first break with home ties when they go away to college and then compete for jobs in a nationwide market, but it occurs all along the occupational spectrum.

What approach to educational planning for manpower needs should a state or a city follow? At one extreme, it may estimate its own needs and train for them (at least in the occupations below the professional level), counting on in-migration of trained workers to match their out-migration. Followed rigorously, this would be a disservice to the students, especially in rural areas in which there is a narrow spectrum of occupational opportunities and substantial out-migration.

At the other extreme, all localities might set up their curricular offerings in a common pattern of national manpower requirements, taking the view that by doing their share of the total job (in terms of their share of the total youth population), they can make their best contribution. This latter extreme is unrealistic, since local industry can rightly ask that its manpower needs should get priority from the school system supported by its taxes.

The best answer as always, lies somewhere between the two extremes. There is no easy way, however, to develop a logical and systematic program for a particular area. One possibility is to allocate a part of the training proportionately to the various occupations represented in local manpower needs, and the remainder (depending on the community's out-migration experience) to those occupations represented in the nation's needs.

These complexities lead local educational authorities to place greater reliance on the desires of the students themselves, assisted in their decisions by vocational guidance. The youth who sees his career in a local machine shop will take appropriate vocational courses in the local schools; the one who wants to live elsewhere, or has his heart set on an occupation not found in that community, will take other training or even go elsewhere to get the training he wants.

Consistent with this point of view are the theses that vocationally oriented education below the college level should be set up on as broad a basis as possible to give the individual maximum flexibility and that the more specific forms of training should be concentrated in the localities where the jobs are and should be available to adults as well as secondary school students. At the college level, greater mobility can be assumed.

Mr. Medvin:

I listened very carefully to Mr. Robson's remarks and literally counted the sentences that he devoted to both national projections and to projections in professional occupations. I found the weight he accorded them as compared to projections dealing with the local scene quite unbalanced. I think this typifies the dilemma of our times; i.e., that vocational education people have a primary thrust in the area of state and local occupational information and in nonprofessional pursuits, yet, those are the areas in which the least information is provided and the greatest technical gaps exist.

Mr. Robson remarked that the committee recommended more model building. I should like to raise a question with respect to that conclusion. I do not want to be in the position of arguing against model building--that would not be a valid position--but I would say there are many difficulties in this kind of approach. The Department of Labor funded several research projects to two universities in an effort to come up with ideas on long-range occupational forecasting.[91,92] These people approached the problem as econometricians. I think one of the chief difficulties is that when you get down to the state and area level, the lack of available data at that level makes the construction of an econometric model exceptionally difficult. Consequently, I am not sure that this should be the main thrust into which we should move at the local level of forecasting.

Next, when you get into the highly sophisticated techniques I have seen thus far, you run into the problem of its implementation at the local level, and one has to consider the kinds of people who can pick this material up and apply it. I would say that from the models I have seen thus far, it would be a remote expectation to believe that we could give to our local Employment Service people the intricate how-to-do-it manuals on model building, plus the perhaps equally difficult task of ADP requirements for their use. My own feeling is that we have to tend toward something which is simpler rather than more complex.

Finally, I think our thrust has to be in terms of exploiting that information that we know we can get before we go on to those techniques calling for data that not only have large gaps in them but, even if improvised, could also not be handled by the available technical competence. Again, I say, this is a recommendation that does not preclude further experimentation at these sophisticated levels.

I would like to address this question specifically to Mr. Robson: "What did the committee recommend, with respect to the gathering of occupational information on a state and local level, that would be viable for the pressing demand of the times, namely the needs the vocational education people have today and within the next two to five years? What did they recommend specifically that we can do?"

Dr. Robson:

The working group concerned itself primarily with projection work being done at the federal level, which was with national projections. The answer is that they said almost nothing of the local problem.

I want to make one plea for model building activity for two very fundamental reasons. One, there is nothing like model building to reveal the data gaps that exist. Very often the data gaps are not really revealed in the absence of model building. The second kind of a proposition I want to defend is that the model-building activity forces planners, administrators and decision-makers to focus on more of the variables that are relevant to decision-making than the kind of simple projections that tend to focus only on a single occupation and a few variables relevant to that occupation.

I think one simple problem is that people who are making decisions about building facilities, adding to curriculums, and hiring teachers are the most numerous group of projectors and forecasters we have in the country. I think what we would like to do is to make an informational base available to this group, but not to control its decisions in any way. With this informational base, this group could check the kinds of decisions it must make. We get this at the national manpower policy level right now. The Secretary of Labor raises an interesting question all the time: "Should we, on the one hand, develop a national manpower policy directed toward the needs of the economy, while on the other, develop an educational system based on what individuals really want to do with their lives?" I do not think there is quite the conflict between these two policies that he believes to exist, but it does highlight a particular set of questions and problems that go to the heart of the educational planning system; that is, the sum of individual preferences and training decisions, in the short run at least, may not necessarily coincide with economy-wide manpower needs.

Mr. Righthand:

Although we have techniques that show the increments in growth for different occupations, what will tell us whether we should train these skills at the post-secondary or the secondary level? And, are industrial needs a controlling factor in making this decision?

Dr. Rosen:

The projection work the Department of Labor does is providing the tools for analysis. It does not provide the answers as to where to train or how many to train. This work offers an approximation of labor force needs, the projection of which considers at least 20 variables. We take into account productivity rate, growth rate, population, shifts in consumer demand, whether we will have a depression, status of peace or war, the retirement rate (broken down by occupation and by industry), and technology and its state of development in a particular industry. Working from a nationwide model of population and labor force structure and then proceeding to industry and occupations, we come up with an approximation of an industry-occupational matrix.

Mr. Swerdloff:

My feeling is that if the whole concept of vocational education is to train a person for a better life, you have made some improvement by training them, rather than just having placed them in a job. You have some economic benefit, even though costs are incurred. The individual who is better trained will likely get a better job, and society has a better citizen.

Chapter 22

FORECASTING OCCUPATIONAL JOB REQUIREMENTS

by

Norman Medvin

Background

The past few years have witnessed the growth of a lively interest among the general public, an increasing concern by government and private administrators, and feverish activity by some specialized economists and econometricians on the problem of creating a viable technique for forecasting long range occupational job requirements.

Collection of occupational data and the evolution of long range forecasting techniques have lagged other aspects of the job market information program. The expense of collecting data by occupation, burdensome employer reporting, the technical inability to translate employer job titles into a standard occupational nomenclature, and difficulty in creating acceptable forecasting techniques are some of the more important reasons why this area of knowledge has not progressed as far as other job market statistical programs.

The abundance of manpower legislation in the first half of the sixties, however, placed an urgent priority on the expansion of occupational information. In providing funds for manpower training, the Congress foresightedly wrote in the Area Redevelopment Act of 1961 that before any training courses could be approved, there had to be a "reasonable expectation of employment" for the trainees on course completion.[93] This all-important phrase was repeated in the Manpower Development and Training Act of 1962,[94] and the concept was carried over into the Vocational Education Act of 1963.[47] No longer was it possible to deal in platitudes or vague references to job opportunities. If a class in welding was to be considered in Milwaukee, a precise determination of employment opportunities had to be made in advance for that specific occupation in that specific place. And if the course was to run for a period of time, the determination of employment prospects had to extend certainly up to, and preferably beyond, the end of the training period.

Current Research in Forecasting

Considerable experimentation has occurred and is taking place in developing acceptable techniques for long range occupational forecasting.

The USES and its affiliated State Employment Services have basically relied on the area skill survey technique and training needs surveys as a means of estimating future occupational requirements. These in turn rest primarily on the validity of an employer forecast of occupational employment in his establishment one, two, or five years in the future, which is summarized for an area or an entire state. Some 170 of these skill surveys have been completed over a period of six to eight years, and 44 are in process.[27]

One of the more important techniques for projecting national occupational levels is one developed by the Bureau of Labor Statistics, which entails preparation of an economic model by building up demand for each product in an industry, manpower requirements of each industry consistent with this demand, and, finally, the development of an occupational matrix. For a grid that has 116 industries in the caption and some 150 occupations in the stub, BLS technicians have painstakingly over a 16-year period filled in the cells so that today they have what is tantamount to 116 industry manning tables for 1960; that is, occupational distributions of employment for these industries. By applying industrial and occupational trends, they have constructed a matrix for the year 1975. By obtaining the difference from one pattern to the other, they in effect have a demand chart by industry and occupation over the 15-year period. In each of these models, there is a lack of manpower supply figures for occupations other than professional and some highly skilled.[95]

Major Difficulties

A gap that is inherent in studies to date, with such exceptions as the area skill survey and to some extent the BLS model, is the absence of labor supply figures. It is entirely possible, for example, for employment in an occupation to increase over a period of time but at the same time for the existing forces in the job market to supply those workers. Thus, one may project an enormous demand for file clerks but because any high school graduate could be part of the potential supply, a prospective shortage would be unlikely. It would be highly dubious to start new training courses on the basis of demand figures alone. Perhaps more importantly, one might have difficulty in using only a demand figure to satisfy the "reasonable expectation of employment" clause since the funding of training courses and successful job search is tied to a shortage concept.

Existing techniques suffer from other limitations. They are (1) extremely expensive (a skill survey for a large city may run as high as $100,000); (2) extraordinarily complex (the Temple University study could hardly be applied at numerous local levels with existing funds, skills, and data processing resources); (3) too time consuming (skill surveys that should theoretically take four to six months to produce preliminary and usable results most frequently take much longer); (4) not applicable to a local scene (the BLS matrix is an excellent national planning document but is not tied to local situations without additional specific adaptation); and (5) not feasible on a frequent basis because of cost, complexity, and time.

The Vocational Education Act of 1963, in allocating hundreds of millions of dollars for vocational training, specifically gives a mandate to the Employment Service system to provide job market information to the vocational school system. The State Employment Services, with no additional funding and with the traditional and costly skill survey technique available to them, have in many instances been unable to provide the information which by law they are obligated to provide.

Need for a New Technique

There is little evidence, based on the availability of current techniques and known experimentation, that a viable method of long range forecasting of occupational requirements on a local basis will be operational on a national basis before calendar year 1967. Excluded, of course, is the skill survey approach, which is operational but which is handicapped by lack of funding. There can be no argument that a new technique is needed as quickly as possible to permit the Employment Service to discharge its function of providing long range occupational information to the vocational education system that would also serve the Employment Service itself in carrying out its responsibilities under the Manpower Development and Training Act.

Two Myths

It is necessary to demolish two myths that frequently divert many technicians who are attempting to work out an approach to the long range occupational forecasting field.

The first concerns "emerging occupations." Many prefaces to research designs and preambles to legislative proposals in the field of occupational job market information have as one of their cardinal objectives the searching out of new occupational opportunities created by changing technology. There is a practitioner in the forecasting field who places major emphasis on this element, and he allocates a significant proportion of his total expenditures in interviewing hundreds of employers for a series of superficial qualitative judgments. Even if these judgments were reasonable and even if it were possible to quantify them, the emerging occupations could not have more than a slight impact on the job market for years to come.

The facts are that the job structure changes rather slowly and that the overwhelming number of jobs and subsequent opportunities are in already existing occupations. Aside from the unusual and infrequent emergence of new industries, most new industries call largely for existing skills. Moreover, emerging skills occur in very small numbers and when they do, it is usual for the machine manufacturer or the machine user to train the worker for the job. By the time the number of workers in the occupation increases substantially, it has undoubtedly been identified in the mainstream of job market information.

Evidence of the numerical importance of the older jobs in the economy is shown by the fact that since the inception of the MDTA program, institutional training in ten occupations, none of which were new to the postwar economy, accounted for the bulk of the enrollments in the program.[96]

The second myth concerns the drive for preciseness in forecasting projections. Models stand or fall on how close the projections are to the actual. Econometricians compute changes to one decimal point, and evaluation studies are conducted repeatedly for accuracy.[97] Endless arguments center around whether the economists or the employer should make the forecasts on the assumption that one is more accurate than the other. Any technique that produces a precise, or reasonably precise, long range forecast is to be desired. It is our contention, however, that this straining for exactitude in the field of counseling and training is largely unnecessary.

For example, what does it mean (if an estimated need in an occupation is 500) when the true need is 250 or 750 (assuming it were possible to ascertain the figure) and when there are only physical facilities or funds for two classes of 25 each? Why the heavy emphasis on an elaborate econometric model when either before the study takes place or after it is completed, the economist programs a major correction factor based on judgment or other nonquantitative data? This was an actual occurrence in a heavily financed study that tried to arrive at a technique at a point far removed from the relevant area by using Census and other data. It was subsequently conceded that there should have been local contact to obtain "the intimate knowledge of an area which only residents have or which can be produced by visits."

Job forecasting to satisfy training requirements, however, should be sufficiently accurate to indicate the proper direction of employment change. In addition to direction, it would be useful to have a magnitude of need, and this can be achieved without satisfying the presumed need for preciseness. Moreover, if a technique can be devised to repeat a survey quickly and inexpensively, say every six months or a year, this would be a better appreoach than one that is locked into an estimate arrived at by a survey that, because of its costs, can be repeated only at three- to five-year intervals.

Elements of a New Technique

The proposed methodology can perhaps be described as the Employment Service unfilled job openings--Ocupational Outlook Handbook approach after its two basic components. Two to three years from now, its name might change to the Job Vacancy--Occupational Matrix approach since these two components will be the improved versions of the earlier elements.

Unfilled job openings are those job orders given by employers to the Employment Service that at the time of count remain unfilled because of a shortage of applicants or inability to find applicants who meet the employer's job specification.* Unfilled job openings are collected on a quarterly basis by the Employment Service in 80 of the largest metropolitan areas in the country. Plans are already under way to extend this collection to 150 areas with some 70 percent of the nation's employment.

The Occupational Outlook Handbook is the Bureau of Labor Statistics' outstanding contribution to the training and guidance fields. Published biannually, the Handbook provides current and long range information on occupations concerning 90 percent of the 16 million employed in professional, managerial, and technical occupations; nearly all of the 4.5 million sales workers; about half of the 10.7 million clerical workers; and about 40 percent of the 9.3 million service workers.

The BLS occupational matrix will provide quantitative information on current employment and long range forecasts of employment by occupation. Most of the forecasts in the current Occupational Outlook Handbook are qualitative in nature.

The final basic tool in the proposed technique is the new and recently issued third edition of the DOT (Dictionary of Occupational Titles).[98] The DOT contains 18,000 defined job titles arranged in an innovative structure that has unique connotations for the proposed forecasting methodology.

Employment Service Unfilled Job Openings

ES unfilled job openings by detailed occupation are an administrative statistic that has been available in the Employment Service for many years. Yet it was only recently, as a result of the first experimental job vacancy studies in the United States in FY 1965, conducted by the U.S. Department of Labor, that the true dimension of the unfilled job openings figure become known.

The job vacancy data showed that for the country as a whole, ES unfilled job openings in April 1965 accounted for 30 percent of the universe of job vacancies.[99] In the second round of experimentation, in April 1966, the ES share of total job vacancies had increased to 37 percent. This average proportion of the job market, which incidentally excludes domestic service, varied by area in April 1965, ranging from 13 percent in the lowest area to 44 percent in the highest.[100]

The relationship of ES unfilled job openings to total occupational needs in a community was literally a research bombshell to the Employment Service system and to many public and private economists. Domestic and foreign manpower experts were surprised to learn that the ES job market exposure compared favorably with some of the highly regarded systems abroad where the employment service is an instrument of an active manpower policy and completely acceptable to the entire community.[101] It is the ES unfilled job openings' penetration of the job market that constitutes the core of the proposed new methodology.

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* This is not precisely true since some job orders may have been given to the Employment Service so close to the time of count that there had not been sufficient opportunity to attempt to fill them.

In applying the technique, the first step is to obtain a listing of the ES unfilled job openings in an area from the local public employment office. These will most frequently be in three-digit occupational groups,* whether based on the second edition or the third edition of the DOT. It is a matter of relative ease for the Employment Service to provide occupational detail beyond the three-digit level.

The most important element in the unfilled job openings figure is not the absolute level of the openings by occupation but a corollary figure, that is, the number of openings that have been unfilled for 30 days or more.† The number and ratio of unfilled openings 30 days or more compared with total unfilled openings for any (three or six) occupation over a period of time provide the clue to current shortages and to a long range projection in that occupation or occupational group.

These unfilled jobs open 30 days or more and their relation to total unfilled openings for each occupation should be evaluated for successive quarters, for a minimum of one year if possible, since seasonality will vary the figures of some occupations substantially.

If the hard-to-fill percentage for an occupation over a period of quarters ranges over a given percentage, say 30 to 40 percent, for a number of quarters, there is evidence to indicate that the occupation is in a continuing shortage situation. These occupations should be identified on a listing and will form the cohort for the next step.

Starting with the list of hard-to-fill occupations and using the number of hard-to-fill openings, that is, those unfilled 30 days or more, as a criterion, the listing should be subdivided into a number of categories. The subdivisions will be subjective depending on the size of area and an analysis of the array. In a large metropolitan area, for example, those occupations with more than 100 hard-to-fill openings that tend to recur over a period of time could go into the first category. Into the second category might be placed those that have between 20 and 99 hard-to-fill openings. The remainder of the occupations would constitute the final category. In smaller areas, the categories should be scaled down by rule of judgment.

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* All DOT occupations are grouped into nine broad categories identified by the first digit 0-9. These nine categories are divided into 84 two-digit divisions, and the divisions, in turn, are subdivided into 603 distinctive three-digit groups. The latter are subdivided into some 3,100 six-digit occupations containing some 18,000 defined jobs.

† These duration data are collected quarterly by the ES as part of its 80-city survey.

The Wage Factor

The ES reporting program not only collects data on hard-to-fill openings but also the reason for their being hard-to-fill. The category of reasons for the existence of hard-to-fill jobs are (1) shortage of qualified workers, (2) low wages, (3) working conditions, and (4) other. Low wages as defined here are not substandard wages, rather they are low in relation to those for other jobs in the area.

On the other hand, if job vacancy data are used rather than unfilled job openings, a certain number of jobs will be hard to fill because they pay substandard wages for the occupation. On a national basis, this proportion amounts to a little less than 20 percent of the vacancies.[99] Consequently, a refinement may be introduced into the vacancy data by using the hard-to-fill figure less those attributed to substandard wages.

Are jobs that cannot be filled because of low wages in relation to the community wage structure to be considered as unsuitable for training? This problem has been the subject of an evolving discussion within the Department of Labor.[102] Among other things, the policy is not to fund a MDTA training course for an occupation that pays below the national minimum wage. On the other hand, jobs in short supply because of a low wage, which, nevertheless, pay above the minimum wage and the prevailing wage in the community are considered trainable occupations from the standpoint of the law. The means taken to assure that trainees will accept such jobs is to screen them and elicit their attitudes in advance. Frequently, these trainees are disadvantaged, and the prevailing wage, although low, is more than they have been accustomed to receiving.

While the foregoing is not intended to be a sophisticated discussion of the wage problem in assessing opportunities, it highlights a difficult problem that the Employment Service constantly faces.

Expansion via Job Vacancy Data

The next step in the progression of this technique is to relate long duration unfilled job openings to the universe of hard-to-fill vacancies in the area. This relationship will produce a series of factors by which a projection of the unfilled job openings data to universe proportions will become possible. Depending on the scatter of the data, the projection could be applied at the one-digit occupational level, the three-digit, or even the six-digit level. Seasonal changes and other special factors that influence the data should be adjusted for.

It is assumed that job vacancy surveys would be patterned after the Department of Labor experimentation, which recommends collection of vacancy data by six-digit DOT titles, a breakout of hard-to-fill vacancies (jobs vacant 30 days or more), and wage data for each job vacancy.[103]

The Occupational Outlook Handbook

The Occupational Outlook Handbook is a document of prime importance containing some 850 pages of data covering the outlook for more than 700 occupations. Projections are on a national basis and most frequently of a qualitative nature. Forecasts are compiled by a group of trained economists in the Bureau of Labor Statistics, utilizing resources of the Department of Labor, other governmental agencies, trade associations, and unions.

This major work, updated every two years, is distributed nationally and is a basic tool for all Employment Service counselors. Employment Service familiarity with the Handbook makes it an ideal component for use in the proposed techniques.

After an array of occupations in short supply by category of volume is achieved, the next step is to assess long range opportunities in those occupations. This is accomplished by reference to the Occupational Outlook Handbook with its national projections by occupation. Against each of the occupations listed in the array, a notation is made of national long range opportunity, adding the number of vacancies in the occupation and the intensity of growth and shortage. A simplified approach would be for the Bureau of Labor Statistics to make a determination of long range demand based on amount and intensity of need for all the occupations listed in the Handbook as the Bureau has already done for skilled occupations.[104] Once done, this would be distributed to all users and would have the effect of substantially cutting down the time needed for individual determinations and also provide uniformity in the interpretation of the data.

At this point, the economist must bring to bear a series of judgments and interpretations. Where the number and percent of hard-to-fill jobs are large and have been large for some time and where the Handbook indicates national expansion, it is entirely reasonable to assume that expansion will occur in the area.

Is there any danger in applying the national trend to the local scene? The proposed methodology assumes that in the bulk of the areas where the occupation exists in large numbers, the pattern of demand will follow the trend of the national projection. Moreover, it has already been determined that these occupations exist in large numbers in the community and have been judged hard to fill on a past and current basis. Conversely, the danger of applying a national projection to a local area would be real where the occupation existed in very small numbers and did not have a hard-to-fill history.

Let us examine existing situations in which a national forecast might be applied to a local area and determine whether such situations can be rationalized. In each of the illustrations, the occupations exist in important numbers in the community and there currently exists and has for a year or more a condition of shortage.

1. The cross-industry occupation. If the national projection indicates expansion for such occupations as bookkeeper, stenographer,

or office machine operator, the broad-based nature of the occupation in the community would not result in serious deviation from the national trend.

2. The specific industry occupation tied to broad-gauged income trends. If the national projection shows expansion for such occupations as bank teller, barber, and occupations in cleaning establishments, the risk of applying growth to a specific community (where a shortage already exists) is minimal.

3. The specific industry occupation tied to national growth and institutional factors. There should be a high correlation between local and economy-wide growth in such occupations as nursing.

4. The occupation in a specific industry in which the national long range projection is favorable, there are current local reports of shortage of certain workers in that local industry, but the long range projection for the plant in the community is not favorable. We have in mind the Studebaker situation in South Bend where there might have been needs reported for tool and die workers and machinists up to the day it was announced that the plant was going out of business. The economist in this case, knowing the precarious status of the corporation, would make an adjustment reducing the estimate of the magnitude of the local need.

   But suppose, as actually happened, the intention to close was a closely guarded secret? No other known technique of forecasting could have produced the right answer either.

5. The industry occupation that is expanding in a local community but for which the national prognosis is contraction. An illustration could be the location of a mechanized meatpacking plant in a new community to consolidate the operations of one or more inefficient plants elsewhere. The local economist can be reasonably secure in his judgment that the recently constructed operation is competitive with the best in the industry and thus would have to be regarded in a different light from the downward employment trend in the industry as a whole. If such a plant exhibited hard-to-fill openings over a period of time, judgment would seem to indicate a positive training decision.

Lesser Skill Occupations

The experimental job vacancy and unfilled job openings surveys demonstrated clearly that there were many jobs of a semiskilled and even unskilled nature that could not be filled for at least 30 days, with the difficulties not being attributed to low wages.

The unfilled job openings handbook technique, by its design, takes care of this generally neglected group. If these occupations have a substantial number of hard-to-fill jobs, they are included in the original of occupations for study. The hard-to-fill figure is considered a measurement of needed supply, no matter how many such workers may be listed in the active file of the employment office. If wage rates are not a factor in the inability to fill the job, it can be concluded that a shortage of workers exists at the time of the survey under prevailing conditions.

Occupations with Small ES Penetration

A major difficulty in applying this technique is related to those occupations in which the Employment Service does relatively little business and in which the number of unfilled openings is consequently small. If these entries represented little or no demand for workers in the community, they would not concern us. If, on the other hand, the unfilled job openings number is small in the Employment Service but large in the community, they are of direct importance to the forecasting process. The Employment Service people in the community will know how to make a distinction between these two groups because they have learned over time which are the employers, industries, and occupations where they have small representation.

Apart from local office knowledge and judgments, however, there are certain safeguards written into the situation. In terms of total actions in the job market, the bulk of such actions takes place in a relatively few occupations. Thus, only 43 (three-digit) occupations constitute 66 percent of the total job vacancies, and these same occupations account for 58 percent of the ES unfilled job openings. Thus, for those occupations numerically important in any community, the local Employment Service office most probably will have representation. Table V-15 expresses this information.

Unfilled Openings and the Business Cycle

The number of Employment Service unfilled openings in 1966 reached its highest peak in the history of the Employment Service, corresponding to the equally unprecedented boom in the nation's industrial establishments. Similarly, ES unfilled openings peaked in 1953 and 1956, two years in which employment opportunities were also plentiful. As might be expected, the number of ES unfilled openings showed cyclical declines during the recession years of 1954 and 1958.

It would be reasonable to ask, therefore, whether the application of the proposed technique would suffer when unfilled openings dropped off in periods of economic recession.

A reduction in numbers of ES unfilled openings, because it would produce smaller magnitudes, would probably subtract somewhat from maximum usefulness of the technique when compared with its use in a brisk job market. Low points in a business cycle tend to affect other techniques of long range forecasting. Employer forecasts in periods of recession tend to underestimate needs substantially. However, a downtrend in the level of

Table V-15

JOB VACANCIES AND UNFILLED JOB OPENINGS: SELECTED THREE-DIGIT OCCUPATIONS* AS A PERCENTAGE OF EACH MAJOR OCCUPATIONAL GROUP

Major Occupational Group	Percent of All Job Vacancies	Percent of All Unfilled Openings
Professional and managerial, 11 occupations (including 6 categories of engineers)	62%	65%
Clerical and sales, 11 occupations	78	64
Service,† 4 occupations	62	47
Skilled, 8 occupations	58	50
Semiskilled, 6 occupations	71	64
Unskilled, 4 occupations	56‡	27
Total	66%	58%

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* List of 43 selected 3-digit occupations, second edition of DOT.

Professional and Managerial: Engineers (metallurgical, chemical, civil, electrical, industrial, and mechanical), social and welfare workers, trained nurses, draftsmen, laboratory technicians, healers and other medical occupations.

Clerical and Sales: Bookkeepers and cashiers, clerks-general office, general industry clerks, office machine operators, secretaries, stenographers, and typists, stock clerks, salesmen-insurance, sales clerks, sales persons, sales--except to consumers.

Service: Waiters and waitresses, kitchen workers, attendants--hospital, porters.

Skilled: Machinists, tool and die makers, machine shop occupations, welders and flame cutters, carpenters, plasterers, mechanics and repairmen--motor vehicle, mechanics and repairmen--other.

Semiskilled: Textile products occupations, machine shop occupations, occupations in the treatment of metals, chauffeurs and drivers, occupations in laundering, cleaning, etc.

Unskilled: Occupations in meat products, packing and filling occupations, transportation equipment laborers, warehousing and related occupations.

† Excludes domestic service occupations.

‡ May be some distortion because of sample inflation.

Source: U.S. Employment Service.

employers' orders would not seriously detract from the usefulness of the ES unfilled openings-handbook technique. In the kind of job market existing in the decades of the fifties and sixties and probably in the decade of the seventies, there will be little change in the nature of structural unemployment. Consequently, we would continue to expect a large proportion of hard-to-fill jobs.

There is some statistical support for this position. An examination of the job vacancy data in April 1965 and April 1966 reveals that even in those metropolitan areas with relatively high unemployment rates, the proportion of hard-to-fill jobs (those unfilled for 30 days or more) was relatively high. Specifically, in April 1965, Los Angeles, California, and Charleston, West Virginia, had an unemployment rate of almost 6 percent, and New York had one of almost 5 percent. These were the three highest rates in the 16-city sample. In none of them was the proportion of hard-to-fill jobs for the area as a whole less than 35 percent.

In April 1956, the same three cities still had the highest unemployment rates in the experimental study but the unemployment rate had fallen to approximately 4.4 percent for each. Again, the proportion of hard-to-fill jobs ranged between 40 percent and 50 percent for each.

High Employment Occupations in an Area

What of those occupations in which there is a considerable number of workers employed in the area that do not show up in the hard-to-fill listings? If nothing else, these occupations generate needs for replacement. Even if there were no long term growth, it would not be prudent for vocational schools to eliminate training for such skills. These occupations can be spotted by referring to the occupational counts by area in the decennial census. Those with the largest numbers should be listed for further examination. To the extent that they duplicate those already listed because of a hard-to-fill history, they present no problem.

The New Dictionary of Occupational Titles

The third edition of the DOT, released in 1966, provides a different structure of occupational classification from the two editions preceding it. Among the innovations introduced was one that has significance for the counseling field and for vocational education and MDTA training programs. The structure as now devised groups occupations according to given combinations of body of knowledge required, purpose, industry, materials worked with, product, and service.

The end result is a structure that clusters occupations with like characteristics under a common heading and also that groups occupations in a "skill ladder." Specifically, with respect to clustering, under metal machining are included the following 10 three-digit occupation groups: machinists and related occupations, toolmakers and related occupations, gear machining, abrading, turning, milling, planing, boring, sawing, and metal machining occupations, n.e.c. The last three-digit grouping contains the "production-machine operator," which together with entry level jobs in the other three-digit groups, feeds into virtually any of the 10 three-digit groupings.

With respect to the skill ladder, each three-digit occupational group has within it the range of occupations proceeding from the top skill in the group down the promotion ladder to the entry occupation. Thus, for the three-digit occupational group "machinist and related," there are included the highly skilled machine shop foreman, the all-round machinist, layout man, machinist apprentice, and instrument-maker helper.

Since each of these three-digit occupational groups relate to one another in terms of materials worked with, product, etc., the training required is somewhat similar at the entry level of all of these occupational groups. Consequently, job opportunities at the entry level would be the number of needs listed for all of the occupations in the 10 three-digit groups. If there is an unfilled need for a machinist, a boring machine operator, and an entry production-machine operator (three in all), presumably in the absence of skilled supply, the need would be to train three entry workers in metal machining occupations. If an employed boring machine operator had sufficient skill to qualify for the machinist's job through upgrading, that would still leave a need for three workers; i.e., two boring machine operators and one entry production-machine operator. Assuming no adequate supply, the training would still be in terms of three entry workers in metal machinery occupations.

Thus, any survey that estimates total opportunities for a list of skills such as baker, machinist, or electrician is only measuring a part of the need. The forecasting technique would have to consider the needs of the entire family of occupations--horizontally to include a number of related six-digit occupations and vertically to include the entire three-digit skill ladder.

The theory of occupational clustering provides the justification for adding together one or more three-digit codes. In the unfilled job openings-Handbook technique, the same theory justifies the addition of related groups of three-digit occupations. This would result in fewer occupational identities but in large numbers attached to those groups that emerge.

In summary, this grouping technique is useful for long range forecasting and for vocational and MDTA planning. The educator who is anxious to obtain a curriculum that exposes the student to a skill cluster rather than to an occupational pinpoint will find that the DOT provides this mechanism.

Tryout in Milwaukee

The unfilled openings-Handbook technique was tested in Milwaukee in the early part of 1967. Milwaukee was selected for a number of reasons.

A special research group of Employment Service personnel, financed by the Office of Manpower Policy, Evaluation, and Research in the Department of Labor, had been experimenting with techniques of setting up a model occupational information system. The reason for assigning the research contract on a model occupational system to the Wisconsin State Employment Service was that the state agency staff had conducted a number of area skill surveys in the past that put them in a good position to assess that technique against others. Milwaukee was one of the original 16 cities included in the experimental job vacancy program and was fortuitously in a position to provide a projection factor to the unfilled openings data.

Following the established guidelines, the State came up with some 100 occupational shortages, current and anticipated, in the metropolitan area, which were then condensed into 47 broader groupings. Each occupation listed was recommended for training activity except for certain groups of occupations in short supply because they paid relatively low wages.

Four illustrations show the nature of the occupational data presented in the Milwaukee survey. The information for these occupations appeared as tabulated below.

Name of Occupation	Average Number of Shortages over Past Year	Intensity of Shortage	Forecast to 1975
Nurse, registered	100+	90%	Rapid
Nurse, aide	30-60	20	Rapid
Machine tool operator	100+	70	Slow
Service station attendant	60-100	60	Rapid

Intensity of Shortage

Intensity of shortage is an indication of how difficult it is to fill job openings for an occupation that, if necessary, could be the basis for the establishment of a priority list for setting up training courses. This is shown as a percent that hard-to-fill jobs in an occupation are of all available job openings in that occupation in Milwaukee. For example, when at least 50 percent of available jobs in the occupation have been vacant for a month or more despite active searching, the shortage might be described as of "high intensity."

Forecast to 1975

The forecast to 1975 is the prognosis given for each occupation or occupational cluster for the next eight years to 1975, estimated by considering local conditions in light of the national picture. A rapid increase implies a gain of 25 percent or more in employment nationally. A moderate increase is a 15 to 25 percent increase in employment, and a slow increase is a 5 to 14 percent growth rate. These growth rates are additions to employment in the occupation and do not include replacements due to deaths and retirements, outmigration, or leaving the occupation.

The trained nurse forecast has persistent heavy shortages (over 100), a high intensity of shortages (90 percent of all the job openings in the area were vacant for at least a month), and a rapid increase to 1975 (over 25 percent).

The nurse aide forecast demonstrates a different job market situation. Needs in the community total over 200 but only about one-fifth (30-60 jobs) are hard to fill. While the small shortage is persistent, it is obviously not intense in relation to total area demand. Nevertheless, the occupation will expand rapidly and thus is a reasonable candidate for training.

A final illustration is service station attendant. The "shortage" of attendants is largely attributable to a low wage situation that causes workers to leave the occupation. The decision to initiate training hinges on official policy toward these types of occupations.

Validation of Milwaukee Findings

The best method of validating the findings in Milwaukee is the passage of time. If the shortage occupations continue in short supply over a period of years, it is reasonable to assume that the initial findings were validated. The concentration of considerable training resources on correcting the imbalance could eventually ameliorate the shortage situation.

Another method of evaluation is to study the placement success of the vocational schools through follow-up studies. Continued job success in the training-related skill would simplify the validity of the forecasting technique.

A comparison of the findings with the area skill survey technique is of little technical significance, although it would have research interest. If the findings should agree, it would probably be fortuitous since the few studies attempting to validate the skill survey approach showed inconclusive results. Conversely, if they should disagree, it would neither prove nor disprove the accuracy of the unfilled openings-Handbook approach. The few studies that attempted to validate the skill survey approach showed random results. Comparisons between the two, while interesting, would be of little consequence.

Conclusion

An assessment of any new technique should consider the following basic observations:

1. The foremost consideration is that any technique developed for widespread use to produce quick results on a continuous basis

must be a relatively simple one. Lack of technical know-how and budgetary resources probably rule out those econometric models produced thus far.

2. The search for preciseness and for identifying emerging occupations in the forecasting area is not necessarily meaningful for training purposes.

3. The unfilled job openings Occupational Outlook Handbook approach is not without its limitations; however, these are no more serious than those in other known techniques and the results, in our judgment, are at least as good.

4. A forecasting system not based on the measurement of supply as an offset to demand is of overall questionable value. The hard-to-fill (openings unfilled one month or more) concept is an adequate and realistic supply measure.

5. Any occupational forecasting system that does not have basic data originating on the local scene chances being unrealistic. We recommend a statewide survey, divided into a number of smaller components; that is, geographical units of SMSAs.

6. The third edition of the DOT is a technical device whose potentialities for providing information on job clustering and skill structure should be combined with a long range forecasting technique.

7. Applying the unfilled job openings-Occupational Outlook Handbook approach requires judgment of the local employment office job market analyst. The job market analyst, dealing with data generated out of his own operations and with continuous economic review of his area, is in the best position to draw valid conclusions. Moreover, by placing this responsibility in the local office, the Employment Service will be discharging its mandate under the law to provide such information.

Chapter 23

MANPOWER REQUIREMENTS TO MEET NATIONAL GOALS IN RESEARCH AND DEVELOPMENT

by

Leonard A. Lecht

Manpower projections can be useful to government, to business establishments, or to groups such as this because they help to reduce uncertainty. They can indicate probable limits to changes in manpower needs and they can also show the probable consequences of pursuing alternative policies, including doing nothing. However, projections are not the same thing as predictions. We are many years away in the social sciences from being able to make successful quantitative predictions for a five- or ten-year period. This is true of manpower projections and it is also true of projections of stock prices.

Many organizations and agencies, public and private, are concerned with manpower projections. The U.S. Department of Labor publishes estimates of the probable demand for manpower in the 1970s in many occupations. The U.S. Office of Education prepares projections of requirements and supply for teachers in the next decade. The National Science Foundation has published similar estimates of requirements and supply for scientists and engineers.

The distinctive element in the projections I am working with is that they represent estimates of manpower needs for achieving national goals in the mid-1970s. These estimates constitute the sequel to an earlier study of the dollar costs of achieving national goals. We are translating these dollar estimates of manpower requirements for some 90-occupations, including scientists and engineers, for the U.S. Department of Labor. Earlier we prepared a separate estimate of manpower needs in the scientific and engineering fields for the Killian Committee at the National Academy of Sciences.[105]

To describe the goals project briefly, we have taken as our point of departure the work of President Eisenhower's Commission on National Goals. The Commission, in its 1960 report, Goals for Americans, indicated areas where changes could be expected because of our nation's purposes in the next decade. We have taken over these same goals to the extent that they could be quantified. Space goals were added after the late President Kennedy proposed in 1961 that it become a national objective "to put men on the moon and bring them back." This we interpret to mean embarkation on a sustained space research program. The areas investigated in our study include virtually all of the nation's expenditures in the private and public sectors of the economy including research and development and space, and also such areas of health, education, social welfare, and conservation and development of our natural resources. The expenditures associated with each of the goals in 1962, the base year for our study, and the anticipated cost of achieving them in 1975 are listed in the Appendix. (See Table V-17).

Goals refer to the future, to our aspirations, and to our plans, as well as to the everyday activities we are engaged in. Our projections for achieving the 16 goals relate to the economic future as we see it in 1975. By 1975 we anticipate a GNP, in dollars of 1962 purchasing power, of slightly under $1 trillion a year. This assumes a GNP growth rate over the next decade of between 4 and 4-1/2 percent a year. By 1975, our population is likely to be 39 million larger, a growth from 187 million in 1962 to 226 million in the mid-1970s. We expect 19 million more persons to be in the labor force. Average family income, again in 1962 dollars, is projected to rise from about $7,250 in 1962 to more than $10,000 in 1975.

With GNP assumed to be $400 billion larger in 1975 than in 1962 and with the civilian labor force projected to grow by 19 million in this period, our economic growth may appear to be so enormous as to suggest that as a nation we could do whatever we thought desirable in the next ten years. However, the number of families is expected to grow by 35 million. There will be an estimated 14 million more students enrolled in schools at all levels of education. Maintaining present standards of living, education, health, and housing for a larger and more urbanized population and providing the additional plant and equipment to produce a trillion-dollar level of output, would absorb a large part, roughly half, of the anticipated increase in resources. The surplus remaining after allowing for this greater absorption of resources can be viewed as a pool of output and manpower to be utilized for realizing agreed on improvements in our society's performance. To illustrate the magnitudes involved, the net cost of all 16 goals is estimated to exceed $1.1 trillion by 1975 (in 1962 prices). As mentioned earlier, GNP is listed as just short of $1 trillion. On this basis, the nation's output would be sufficient for realizing most, but not all, of the objectives included in the present aspiration goals.

The demand for scientists is primarily related to the nation's expenditures for research and development. Only part of the demand for engineers, perhaps not much more than one-fourth, is directly related to expenditures for R&D. Otherwise, the demand for engineers reflects the general level of economic activity, i.e., the trillion dollar GNP we have been talking about for 1975. The construction industry, to cite a current example, employed some 53,000 engineers in the early 1960s. While this industry employed about 5 percent of all engineers in that period, it only accounted for the employment of a fraction of 1 percent of all R&D personnel.

R&D accounts directly for only a part of the total employment for technical manpower, yet what happens in R&D is probably the critical element--the force making for change--that over a five- or ten-year period influences employment in scientific and engineering fields, primarily so through the development of new processes and products.

Expenditures for R&D tripled in the ten years after 1953, rising from $5 billion in 1953 to $17 billion in 1963. With R&D expenditures amounting to 3 percent of GNP in the early and mid-1960s, R&D, for the first time in the nation's history, has become an important element in the economy's expenditures and use of resources.

As a result of these expenditures, we have created a new enterprise, the R&D enterprise. In many ways, the R&D enterprise is a separate industry in the sense that health and education are industries. The R&D industry creates employment for many people other than scientists and engineers. We estimate that in 1962, more than 2.2 million persons were directly employed in the R&D industry or they were indirectly employed in producing goods and services that constituted inputs for R&D enterprises. Between 450,000 and 500,000 of these people were scientists and engineers. The research and development industry also created employment for some 150,000 technicians, for 300,000 clerical workers, for 500,000 operators, and for 100,000 service workers, including 20,000 charwomen, janitors, and porters and 10,000 guards, watchmen, and doormen. Over half of this employment was associated with the durable goods industries, mainly aerospace and electronics.

It is reasonable to anticipate that the manpower requirements in R&D enterprises in the next decade will reflect the overall growth in R&D expenditures, the distribution of these expenditures, and the growth in the productivity of R&D workers. About two-thirds of the $17 billion in R&D expenditures in the United States in the early 1960s were financed by the federal government, although private industry performed most of the research. About 90 percent of these federal expenditures are attributable to the role of R&D as a means for achieving national objectives in defense, atomic energy, and space. About 10 percent of the total represents basic research; that is, research undertaken to increase and improve our scientific understanding.

We anticipate that R&D will continue to grow in the next decade and that the federal government will remain as the primary source of R&D funds. However, we also expect that more of the R&D budget will be allotted to basic research and to what might be called "civilian economy" R&D. This would include R&D in such areas as oceanography to devise effective means for "farming" and "mining" the oceans, health, conservation of our natural resources and devising of substitutes for them, elimination of air and water pollution, mass transit, and industries that currently conduct little R&D (the construction industry is an example). Achieving these objectives would raise total R&D expenditures from the $17 billion they constituted in the early 1960s to an estimated $39 billion in 1975. This would represent an increase from 3 to 4 percent of GNP.

Translating these dollar expenditures into manpower requirements, we estimate that achieving this $39 billion level of R&D expenditures would create employment for over 4 million persons in 1975. (See Table V-18). This represents an increase of about 100 percent over 1962.

Of this 4 million total, about 950,000 would represent scientists and engineers. In addition, we estimate that the economy would require an additional 1.5 million engineers in 1975 to operate the industrial plant, for construction and transportation, and to maintain and expand our social overhead facilities such as schools, hospitals, roads, and parks. This adds up to a requirement for more than 2.4 million scientists and engineers in 1975 to achieve all the national goals. This figure is 1.2 million greater than the number of scientists and engineers employed in 1962.

It is characteristic of our nation's history to adopt objectives that exceed our reach, and these objectives, in turn, serve as incentives for taking steps to make greater progress than would have been considered possible with more modest aspirations. This is probably true with R&D as it is with our other national goals. However, even if we continued spending at the 1962 rate of 3 percent of GNP for R&D, we would still be spending $30 billion for research and development in 1975.

The estimates of manpower requirements for achieving goals such as R&D can indicate, in a somewhat magnified manner, the job development needs, education and training needs, and employment opportunities that would frequently occur as we pursued our R&D objectives at levels that were consistent with the nation's resources and with other national priorities in the next ten years.

To return to scientific and engineering manpower requirements, in the earlier study prepared for the Killian Committee, we estimated that the replacement demand for scientists and engineers would amount to about 330,000 between 1960 and 1975. All told, the increase in demand due to growth in requirements and to replacement needs is projected to total approximately 1.5 million by 1975. We concluded in our study for the Killian Committee that, if recent tendencies in enrollments in scientific and engineering curricula were to continue, our nation would fall short of meeting its needs for scientists and engineers by 300,000 by 1975. However, these projections of shortage represent an extension over time of one of the alternatives in the future demand and supply for scientists and engineers--the changes of the recent past. Many developments could happen over the next decade that would outmode the shortage projections.

While we have no ready answers as to what these developments will be, we do have some clues. One of these is indicated by some data on the number of physicians, nurses, medical technicians, and engineers per 100,000 population in the United States. In 1940, there were 133 physicians per 100,000 population in the United States, and in 1960, there were still 133 physicians per 100,000 population. However, the number of graduate nurses per 100,000 increased from 216 in 1940 to 282 in 1960. The ratio for medical technicians grew even more rapidly, from 15 per 100,000 in 1940 to 38 in 1960. However, if we examine the corresponding ratio per 100,000 engineers, it rose from 225 in 1940 to 478 in 1960.

The anticipated growth in requirements for technical manpower would increase less rapidly in the coming decade if the precedent of medicine, that is, economizing in the use of highly trained professional resources, were followed. The great strides in health in the United States in the past generation have taken place with very little change in the ratio of physicians to population. Many of the routine tasks in medicine have been turned over to nurses and to medical technicians. It is likely that technicians could also do much of the routine testing and production control work currently performed by engineers. Developing an adequate supply of trained technicians would make new demands on our educational system. In much of Europe, technical training of this type is conducted in schools offering two-year posthigh school instruction in basic science and applied techniques. The success of such a program in the United States would probably be facilitated by the cooperation of educational institutions and the industries using scientists, engineers, and technicians.

Our prospects for achieving our manpower requirements depend to a large extent on progress in education, especially in higher education for scientists and engineers. Enrollment in all institutions of higher education in the fall of 1963 was about 4.5 million. An increase in the enrollment figure to more than 9.5 million would probably be needed to satisfy the manpower requirements implied by all our national objectives. With this enrollment level, we estimate that the number of bachelor and first professional degrees in basic and applied sciences, including engineering, would exceed 200,000 in 1975. This compares with approximately 115,000 of these degrees in 1962.

Population growth alone could be expected to increase enrollment in higher education by some 2 million over the next decade. Expanding educational opportunities through greater public and private support for higher education would be the main source for obtaining additional enrollment beyond this level.

Opportunities in higher education have increased at an unprecedented scale in the past generation. However, family income is still an important factor in the decision on whether to attend college. A survey discussed by the Senate Subcommittee on Employment and Manpower several years ago reported that 13 percent of the young people who came from families with annual incomes of less than $4,000 went on to college compared with 47 percent from the families with incomes over $7,500. These differentials reflect attitudes toward education as well as family income. However, the net result, as summed up by the Subcommittee in 1964, is that "the nation . . . is losing through leakages in the education system, a substantial portion of its brains and leadership potential."[106] Part of this loss of brains could probably be recovered for science and engineering if more students from low income families were to receive a higher education. The Higher Education Act and the National Science Foundation's fellowship program are significant indicators of our nation's determination to reduce sharply, if not eliminate, the importance of family income in the decision as to who will attend college.

There would also be fewer barriers to meeting our nation's requirements for scientists and engineers in the 1970s if we could make more use of the potential skills of the groups that represent our society's concentrations of underutilized and unutilized human resources. The two largest groups of these reserve resources are women and nonwhites.

By the mid-1960s, women made up a third of total civilian employment and well over a third of professional and technical employment. However, the rapid growth in R&D expenditures has scarcely affected the employment of women with professional and technical skills. To use engineers as an illustration, there were 3,000 women engineers in the United States in 1964. This was a fraction of 1 percent of the total number of engineers. About 10 percent of the scientists were women. The stereotype of a "man's job," usually associated with occupations requiring heavy physical labor such as working in a mine or foundry is equally true of the engineering occupations and slightly less true in the sciences. Similarly, in 1964, nonwhites made up a little more than 10 percent of total employment. There were some 22,000 nonwhite engineers, or under 3 percent of the total, and some 7,000 nonwhite scientists or about 4 percent of the total.

There are, of course, substantial historical reasons for the underrepresentation of women and nonwhites in science and engineering. Most college women plan to get married, rear a family, and return to work after the children are off to school. This is difficult to do in fields such as science where developments may change radically from one year to the next. However, if we had extensive adult continuation education for professional women and other groups, it is reasonable to expect that more women would be encouraged to enter the scientific and engineering fields.

For nonwhites, differentials in education and a very human tendency to prepare for occupational fields with the minimum barriers to entry are probably as important as overt discrimination in accounting for their underrepresentation in scientific and engineering employment. There is considerable evidence in the past few years indicating that discriminatory barriers in engineering have been lessening substantially.

In the 1970s, nonwhites and women are likely to make up a larger share of the labor force than in the early and mid-1960s. By 1975, it is estimated that 40 percent of the women who are 14 or older will be in the labor force. Nonwhites will make up a larger share of the nation's labor force in the next decade because of their higher birthrate. From 1960 to 1965, to cite some recent figures, the nonwhite population under 14 years of age grew by 14 percent. The corresponding figure for the white population was 5 percent. While there are limits to the extent to which more women or nonwhites could be trained and educated to be scientists and engineers in a decade, their underrepresentation in these fields indicates the potentials for increasing the supply of scientists and engineers to meet national requirements.

In conclusion, it is unlikely that the attainable rates of GNP and labor force growth would enable us, as a nation, to achieve fully the targets for all our goals in the next decade. If this were our overriding objective, the anticipated shortages of highly trained manpower would be paralleled by similar deficits in pure water, timber, transportation facilities, and industrial plant. However, vigorous pursuit of our nation's objectives, including R&D, could be a major factor in attaining a closer approximation to our aspirations and in attaining the trillion dollar GNP anticipated for 1975. The extent to which we can meet our scientific and engineering manpower needs for these purposes in the 1970s is likely to depend on what happens to our educational system in the next few years and on the degree to which we make full use of the underutilized human resources in our society.

Data pertinent to this chapter are shown in Tables V-16, V-17, and V-18.

Table V-16

EXPENDITURES FOR INDIVIDUAL GOALS
1962 and Projected for 1975
(Millions of 1962 Dollars)

Goal Area	Expenditures in 1962	Projected Expenditures for Aspiration Goals in 1975
Consumer expenditures	$355,050	$659,600
Private plant and equipment	48,900	151,600
Urban development	64,200	129,700
Social welfare	37,800	92,400
Health	32,300	85,400
Education	30,400	82,100
Transportation	35,100	75,400
National defense	51,450	67,550
Housing	29,400	62,000
Research and development	18,300	38,850
Natural resources	5,900	16,700
International aid	5,100	13,150
Space	3,250	9,350
Agriculture	7,200	9,200
Manpower retraining	100	2,850
Area redevelopment	350	950
Subtotal	$724,800	$1,496,800
Less double counting and transfer adjustments	164,500	369,800
Total	$560,300	$1,127,000

Source: L. A. Lecht, The Dollar Cost of Our National Goals, National Planning Association, 1965.

Table V-17

EMPLOYMENT BY OCCUPATIONAL GROUP FOR THE R&D GOAL
1962 and Projected for 1975

			Projections for 1975		
	1962		For Aspiration Goals		
Occupational Group	Percent of Total	Number Employed (Thousands)	Percent of Total	Number Employed (Thousands)	Percent Increase
Professional, technical, and kindred workers	32.6%	737	36.4%	1,562	112%
Managers, officials, and proprietors, except farm	5.8	131	6.0	259	98
Clerical and kindred workers	13.1	296	11.7	502	67
Sales workers	2.9	65	2.4	101	55
Craftsmen, foremen and kindred workers	12.9	291	13.1	564	94
Operatives and kindred workers	23.0	519	22.3	958	85
Private household workers					
Service workers, except private household	4.2	95	4.4	191	101
Farm workers	1.0	22	.5	21	-5
Laborers, except farm and mine	4.6	103	3.2	137	33
Totals	100.0%	2,259	100.0%	4,295	90%

Note: Detail may not add to totals due to rounding.

Table V-18

EMPLOYMENT BY DETAILED OCCUPATION FOR THE R&D GOAL, SELECTED OCCUPATIONS
1962 and Projected for 1975
(Thousands)

Occupation	1962	For Aspiration Goals Projections for 1975	Percent Increase 1962 to 1975
Designers and draftsmen	21	41	95%
Engineers	257	519	102
Natural scientists	180	356	98
Technicians, electrical and electronic	42	124	195
Technicians, medical and dental	4	11	175
Technicians, other	115	295	157
Salaried managers	94	223	137
Secretaries, stenographers and typists	77	146	90
Foremen	47	112	138
Machinists and job setters	35	71	103
Mechanics and repairmen, other	54	102	89
Assemblers	57	94	65
Checkers and inspectors, manufacturing	36	74	106
Truck and tractor drivers	40	79	98
Welders and flame cutters	26	57	119
Charwomen, janitors and porters	23	44	91
Laborers, except farm and mine	103	137	33
Total	2,259	4,295	90

PART VI: PROBLEMS OF EVALUATION AND ORGANIZATION

Chapter 24

EVALUATION

Background

Evaluation is concerned with how well the enterprise or institution is performing as measured against the plan, the program, and the objectives and goals that have been set forth. It is an important part of the planning process, since it provides continuous feedback to spur remedial action when deviations from the plan occur; to achieve the plan; or to revise, adjust, or recycle the plan. The effective performance of this function requires staff capable of performing qualitative and quantitative analytical studies.

The distinction between analytical techniques employed during planning and programming and those used in evaluation is most meaningful in terms of the phase of management cycle. Planning is concerned with the future outlook for present decisions, whether the plan is short, intermediate, or long range in nature. Evaluation is concerned with measuring the effectiveness of performance against the plan, usually after the fact, but including the anticipation of what extension of performance rates of current progress implies to the achievement of the plan on schedule and in a balanced manner. Some research studies and measurements will serve both planning and performance measurement functions.

It should be clear that there are many types of measurements of program performance that can be undertaken. Vocational educators continuously try to improve their observation and measurement of mental abilities and behavioral outcomes of the learning process for specific courses or course sequences in terms of the individual's mastery of the subject matter. Standard tests have been produced, validated and used for many occupations such as typists and stenographers and applied to thousands of students. Norms, or average performances, have been established with which individual or group performance can be compared. Norms may be established nationally for standard use or developed for local use. Although important, the evaluations considered in this report are not concerned with this type of measurement, except in relation to economic efficiency determinations.

Earlier in this volume, the distinction was made between overall objectives and goals and subsidiary objectives. The behavioral outcomes that are the concerns of professional educators concerned with curriculum development are important and are related to these derivatives. The evaluations that this research is concerned with relate to the economic analysis supporting the decision-making process, measuring of the extent to which resources have been wisely allocated, optimization of results, and pointing out of deficiencies and recycle operations where appropriate.

Kershaw and McKean proposed evaluating educational outcomes as measured by test scores and as related to varied combinations of resource inputs, such as teacher-student ratios, audiovisual aids, and teacher salaries.[88] The SRI reconnaissance surveys found that the type of evaluation proposed by Kershaw and McKean was not being conducted by any of the states or communities visited. The promise of computer-assisted instruction, team teaching, programmed instruction hardware and software, audiovisual aids, and other developments in educational technology have so far received only nodding attention from managers of vocational educational institutions, with some few but significant exceptions.*

There are multiple explanations for the lack of attention given to economic analysis of educational allocation decisions. First, economists gave much greater attention until recently to revenue and tax matters for school systems than to the final products or outputs of the educational process. Second, for many decades, the educational establishments were insulated against this type of economic scrutiny. Because total resources made available were not as large as currently and prospectively requested, education did not in the past face such severe competition with other programs seeking public funds. Third, within education, there is internal competition for funds among different programs and courses and among different alternative resource inputs to achieve specific behavioral objectives. Broader views of more varied alternatives are now possible with accelerated innovation and technology, plus the use of money made available by substantial federal grants for experimental and demonstration studies. Fourth, the schools are looked to with ever greater urgency to help alleviate problems of the disadvantaged through education and training and the introduction of social change, thus helping to achieve multiple objectives, including the reduction of social tensions. Fifth, many elements of society such as legislatures; economists; political scientists; parent-teacher associations; university researchers; governors, mayors, and other elected executives; unions; and community action groups press for allocations to be made for particular purposes.

The absence of the profit motive and of the competition of the marketplace with its price mechanism makes it more difficult to achieve highly efficient allocation of government resources compared with the private sector. The incentives in public affairs to seek innovations and more efficient ways to achieve goals are not based on profits. The avoidance of decisions or the cost of poor ones does not usually result in penalties being imposed on those who make them in the public service. However, now that the increase in government activities is reflected in spending amounting to more than $157 billion annually and employment in the public service has increased to one out of seven persons in the labor force, it is essential that better analysis be conducted to assist optimum allocation of resources.

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* See David S. Bushnell and Robert M. Morgan, An Educational System for the Seventies, this report.

In evaluation, the choice of the right criteria and the asking of the right questions are crucial and essential to the analysis required to assist decision-makers. In the surveys of the selected states and communities, it was apparent that little attention had been given to criteria. Because overall objectives and goals for occupational education are set primarily in terms of facilities constructed, enrollments, teachers and counselors added, and other resource inputs, little measurement is conducted of the net economic value of the final outputs of the educational process--the students graduated and placed in jobs and their income stream measured in benefit/cost terms. Very little evaluation was made of alternative ways of achieving objectives and goals, since little effort was spent in structuring or considering such alternatives, as previously described. The following report of findings, therefore, reflects the lack of attention by educators to economic or systems analysis in relation to output or the final goals of the educational process.

Findings

The deficiencies previously described, attributable to the lack of an integrated PPB system and the deleterious effect of this lack on decision-making, have a corollary impact on the evaluation phase of the vocational education management cycle. None of the jurisdictions visited had a formal plan or program with priorities established for the systematic evaluation of the economic worth of vocational educational programs. Program reviews and analyses, although providing some useful insights into program accomplishments, fall far short of providing boards of education, superintendents of instruction, and legislative bodies with the information required to make wise allocation decisions. As pointed out earlier in this report, there are many high priority problems not now being analyzed and many data gaps that require remedial attention. The U.S. Office of Education has started several projects such as this one that are designed to help correct such deficiencies, but favorable results are not yet manifest at the state and local levels.

The reconnaissance surveys found great variation in both the effort and quality with which the states and communities conducted evaluations. Some of the states have formalized their approach to evaluation and established guidance and criteria for use by their evaluation staffs. Other states and communities selected projects for evaluation on an informal basis. Some of the individual projects were highly structured, while some of them were designed to obtain impressions through telephone or personal follow-up interviews with employers, students, and other respondents.

One state conducts a formalized evaluation of all schools that offer programs designated for Associate Arts degrees. The schools must pass this evaluation to receive state certification. A team of staff members from the state government visits the school to determine whether a formal evaluation is merited. Immediate recommendations are given, and if the center passes the pre-evaluation, a different team formally evaluates the school's total program. The formal evaluation team may include individuals familiar with the types of programs the school offers, directors of other vocational and technical schools, state staff members, persons from industry, and representatives from the university system. The checklist used is geared to general administration of the school and its program; teacher performance and student performance against norms (see Appendix B).

Program evaluation is also accomplished by program advisory committee staff members in another state. The objective of the evaluation is to determine the extent to which the school's program is being accomplished. Such evaluations are mandatory after two years for a new program but are often performed at the end of the first year of operation. In addition to the specific criteria listed in the checklist for program evaluations (Appendix B), information such as placement statistics, projected needs, and student comments is obtained. Teacher performance, administrative policies, facilities, library, curriculum, student services, use of advisory committees, and future planning are all criteria included in the formal evaluation checklist.

Most states conduct some follow-up studies on graduates every year, which is required under the Vocational Education Act. This has been done annually in one state for the last 25 years. Gross placement on the average is reported to run around 85 percent. However, no control groups are used in this survey so that it is not known how well the students would have done in the absence of training. At the time of the field work, another study was just being finished on graduates of five years ago. The state is now setting up a procedure for doing such a follow-up study every five years. Another follow-up study was done asking graduates what they wanted in school and did not get; most of them recommended more intensive instruction in mathematics. The graduates, however, did not recommend any more social sciences.

Evaluation of the results of vocational education are conducted in many areas. In one state, a study was made of enrollees in secondary vocation-technical schools in 1964-65 that showed approximately 14.5 percent dropped out or transferred during the year--or 1,004 out of 6,982. Overall, there were 145 terminations before completion in machine courses, 100 in carpentry, 170 in auto mechanics, 88 in electrical, and 75 in drafting. The dropout rate varied from 7.4 percent in one school to 28 percent (115 out of 409) in another. The analysis contained quantitative data only and no interpretation or implications for planning or programming. Performance at the high dropout schools was not analyzed in comparison with performance at the low dropout schools. Was the dropout rate due to teacher performance, variations in quality of counseling, or a host of other possible reasons? The payoff in the evaluation appears to have been missed--even in terms of effectiveness--along with useful implications for further planning.

Some of the evaluation projects in the states and communities are concerned with follow-up studies of the percentage of graduates placed in training-related occupations. One state conducted a five- and ten-year graduate follow-up study. Some of the more significant findings showed that: (1) two-thirds of the 1953 graduates were still employed in their trade or in a related occupation ten years after graduation, (2) three-fourths of the 1958 graduates were still in their trade five years after graduation, and (3) the average 1963 salary was $7,085 for the 1953 graduates and $5,746 for the 1958 graduates. Since no control groups exist, the net effects of this training cannot be ascertained.

A study of 1965 graduates by the research coordinating unit in the same state as above provides a breakdown of placement data by courses and by training institutions for each of the vocational programs having graduates in 1965. These included distributive education, technical institutes, vocational-technical schools, and vocational agriculture. Data processing techniques were used to compile the report. The follow-up evaluation was made of 2,736 graduates, showing the number of graduates as well as their mean hourly wages. Eighty-five percent were placed in the occupation for which trained or in a related occupation. Placement data show, for example, that in one school 100 percent of the graduates (46) of a training program were placed as practical nurses. In another school, ten graduated as electronics technicians. Five of these entered the Armed Forces, one continued training, and four were available for employment; of the last, two were placed. Again, the absence of control groups and benefit/cost analyses preclude determination of the net economic effects of such programs.

Such studies have great value as indicators of the effectiveness of the training effort, but suffer from methodological flaws, the main one being the lack of a proper control group. The follow-up studies of graduate placement suggest that the states have some of the data at hand to permit setting goals in output terms--the number of graduates to be placed by job classification and by occupational categories in relation to estimated demand. However, the value of such studies are limited for PPBS purposes, since they do not provide sufficient information to permit meaningful analysis to determine whether certain of the objectives of education are being accomplished. They do not, for example, permit analysis of the benefits and costs of training, since the data are not now collected.

Benefit/cost analyses, or comparative effectiveness studies, for example, of general academic study graduates compared with vocational-school graduates, could be very valuable to planning. For these, however, more data than are now available are required. The 1965 studies mentioned above do not include enough years to permit a determination of benefits.

Costs are not collected to compare with benefits. The net value added by vocational education for particular specialties is not even considered. Such evaluation studies, therefore, have limited utility for planning and programming.

Benefit/Cost Analysis

The above findings suggest a basic difference of effectiveness/cost analysis from benefit/cost analysis. Given a specified target placement ratio, effectiveness/cost analysis can tell how to achieve it most efficiently, but benefit/cost analysis would actually bring the placement ratio itself into the analysis and help specify, at least in market terms, a structure of curriculum offerings that would result in even higher net placement. With effectiveness/cost analysis, one can specify a pattern of placement ratios that would be such that the distribution of occupations for which training was undertaken would conform very closely to relative market needs; however, it seems likely that optimal results would be more easily achieved using benefit/cost analysis, which would divert attention from placement ratios and toward net earnings or wage differentials. Such a structuring of evaluation would be directed at economic efficiency objectives and goals, while effectiveness/cost measurement could be related directly to achievement of the educational goals pertaining to efficiency of the learning process.

No evaluations were performed that would permit comparisons of the benefit/cost or effectiveness/cost of vocational and technical education compared with that provided by proprietary schools, religious schools, or on-the-job training. No benefit/cost or effectiveness/cost analyses were conducted to compare alternative programs with respect to the occupational categories for specific courses within a single occupational category. No systematic, long range plan was found to exist for the conduct of evaluation or for the establishment of priorities for evaluating projects.

Significant deficiencies in data available must be overcome before meaningful evaluations can help to resolve some of the issues raised in this diagnostic summary. The absence of the data is merely a reflection of the many deficiencies in the planning and programming of vocational education as now conducted.

Prestige and the Dignity of Work

Education of the disadvantaged is one of the objectives of vocational education and manpower policy that is receiving greatly increased attention from all levels of government. The riots in the slum areas of many major cities of the country in the summer of 1967 served to accentuate the urgency of high priority attention to problems of this group. Educators, counselors, and others working with the disadvantaged often cite the fact that the disadvantaged frequently lack the motivation of other members of society and are frequently alienated from society. The very real problem for educators, becomes how to educate and train the disadvantaged so that they can enter the world of work with pride and make a contribution to economic and social life.

Many existing barriers that must be given attention are not of the educator's making and beyond his powers to remedy. A recent report finds that: "the available evidence for the country and for particular areas demonstrates that, with recent exceptions, there have been very few Negro apprentices in the United States. The U.S. Census Bureau reported that Negroes constituted 1.90% of apprentices in the labor force in 1950, and 2.52% in 1960." [110] The report details the findings on reasons for such low participation rates.

The Washington Post of August 17, 1967, reports that the Capitol Power Plant, a government agency, has 19 Negro employees out of a staff of 87. The Negroes complain that they are forced to use separate wash and locker rooms from the whites and that these are not kept as clean or in good order. Further, they charge that they enter with a lower wage rate and are passed over for promotion because of race. The effect of such situations on the motivation of Negro youths in the classroom could be quite depressing and could make for greater difficulty for the teacher in achieving educational goals. This is cited to illustrate the carryover of conditions external to the school system that directly affect the educational process. This kind of problem obviously cannot be solved by educational institutions alone.

There are 74 million persons employed in the United States today who are 14 years and over. Of these, only 23 percent are professionals, technical and kindred workers, managers, officials, and proprietors. The rest are blue collar workers (37 percent), clerical and sales personnel (22 percent), service personnel (13 percent) and farm workers (5 percent). Although the great bulk of jobs (77 percent) are other than professional, technical, or managerial in nature, the entire drive of our society focuses on having the young aspire to professional and kindred elite positions. Teachers and counselors in secondary schools give most of their attention and resources to getting college-bound youths into good schools. The parents share the prevailing attitudes and place pressures on their children. The students accept and then project the aspirations demanded by the pressures built up within the environment. Television and all the communications media add to this value system by glamorizing the success of professionals, executives, and members of the technical and managerial occupational groups.

Setting aside for the moment the question of wage levels, it is understandable that there are key shortages in some occupational specialties such as automotive and aircraft mechanics, health occupation workers, and other specialties below the top of the occupational pyramid. The fact that some professionals, such as school teachers, are paid much less than some of the blue collar workers (for example, master plumbers, electricians, and tool and diemakers may be paid up to $16,000 a year), hardly makes a dent in prevailing attitudes, so great is the emphasis on aspiring to the elite occupational categories in our society. Our economy could not be kept going without the majority of workers who occupy other than the elite positions. Since the facts of life are that most of the working population will be entering blue collar services or clerical and sales jobs, it would seem that a great effort should be made to gear the thinking of teachers and managers of educational institutions, the employers in the private sector, communications media, parents, and the school system itself to these realities. Secondary and postsecondary school systems should be designed to turn out individuals with the skills essential to perform the work of society. It is pointed out by Garth Mangum that we now have an academic track geared to accommodating college-bound students, a vocational track geared to preparing individuals for the world of work at a subprofessional level, and a general track that leads nowhere into which some children are pushed in a mindless sort of manner. There needs to be much more research performed on how all kinds of essential work can be given dignity, prestige, and financial and other rewards so that the individuals performing blue collar work or construction or service work can perform it with pride. Much more research is needed in identifying the problems and in finding courses of action for their solution.

The problem of pride and the dignity of work affects the teaching profession itself. Comments were sometimes heard to the effect that the vocational educator is a second-class citizen in the educational world, looked down on by his colleagues in the universities, the technical institutes, and the secondary schools. If first-class attention is to be given to the gifted child and the college graduate, a pecking order is established. The next order is the teachers concerned with education of the technicians and the academic students who will attend a few years of college or take some technical training and so on down to the vocational educators and their students. In the surveys, we interviewed one head of a technical institute whose facility capacity was one-third underutilized and who could have trained some disadvantaged persons in skills such as automotive repair, which was in high demand in the community. A new occupational skill center was being established as part of a manpower program to undertake instruction in automotive service and repair at the entry level, adding even more capacity to the area training ability. The institute head said that he had built up relationships with the employers in the area who hired his well-qualified students. He did not wish to destroy this excellent relationship by training inferior students from the disadvantaged group who would most likely perform less ably once placed. More research needs to be performed on the attitudes of the teachers, counselors, and others in relation to the expressed goals of vocational and technical education and manpower training.

Chapter 25

ORGANIZATION FOR PLANNING

The managers of education at all levels require planning staffs with the capacity to use the best modern planning and decision-making tools to help them accomplish their objectives. There are many significant impacts on education that underscore the need for full-time planning staffs to assist management of educational institutions in performing their work. The amount of resources for education must face competition from other demanding and high priority claims made on public funds. The environment in which educators must carry out their function becomes ever more complex, with changes in technology and shifts in the distribution of workers, making it increasingly difficult to forecast future job demands. The many alternative courses of action available to achieve educational objectives and goals requires an analytical capability to examine their comparative monetary and nonmonetary benefits and costs and display these in a meaningful fashion.

The reconnaissance surveys found that planning was performed on an ad hoc basis by provisionally organized committees. The director of vocational education and his deputy would frequently take time away from other pressing and demanding tasks to form a planning committee with a few other selected officials such as division heads. The director and his aides have broad responsibilities for all aspects of the program, including the establishment of liaison with other state agencies such as the board of education, the department of labor, the budget office, the legislature, and representatives of regions and townships. Obviously, their full time cannot be given to planning.

As a result, planning and programming originates from the base of experience in prior years, with changes from that base receiving the attention of the ad hoc planning committee. Such changes would include, e.g., the introduction of new types of program offerings, the need for new facilities, or the need for added teachers.

There are two exceptions to this planning situation in the larger states and communities. Assignments are made within each major division to individuals in the area of curriculum planning. There also will be two or three persons assigned on a full-time basis to plan for new facility construction or improvement of existing facilities.

Many of the national, state, and local leaders in vocational education have been concentrating their efforts on refashioning vocational education to meet the changing needs of the world of work. However, they do not have the long range planning staffs with the analytical capabilities that would help them with an integrated PPB system and evaluation to make vocational education fully responsive to current and prospective labor market needs. Such analytical capability is essential, since there are rigidities and other built-in factors in any institution that contribute to inertia, preservation of the status quo, and resistance to change. For one thing, facilities and equipment have been put in place at some expense, and there is a natural hesitancy to abandon them. Even if the will is there, difficult battles may have to be fought with a reluctant legislature. In addition, the faculty of vocational education schools consists of individuals trained to be home economics teachers, teachers of office occupations, teachers of technical training, and the like, sometimes with skills limited to only a few job courses within their occupational specialty. A decision to decrease home economics training and increase technical training immediately runs into the rigidities imposed by the distribution of skills and capabilities of the teaching staff. Further rigidities may be introduced by parental and student attitudes and interests, reflecting continued support of past program offerings and resistance to change. Additional constraints are imposed by the accretion of legislative enactments, administrative decisions, rules, regulations, policy guidelines, and operating procedures. Such requirements, for example, may insist that all faculty members must have teaching certificates. There may not be a sufficient number of teachers to accommodate training in a rapidly expanding area of increased job demand, such as technical training. The system may be unresponsive to the need, unless some manner of easing requirements for the recruitment of faculty is found.

The boards of vocational education at the state level and similar organizations in the communities surveyed do not currently have on their staffs economists, operations research analysts, or systems analysts and they do not have formally constituted planning organizations. Occasionally, they will let contracts for research on a particular project; however, continuing analytical capability essential for effective performance of the planning function is not now available to management of educational institutions.

Recognition of the need has led to action by at least one state and two communities to establish a long range planning capability, and other jurisdictions have expressed interest. The Civil Service Commission and the U.S. Bureau of the Budget, under direction of the President, have developed training programs to encourage action in this direction.

Programs to assist the states in strengthening planning departments have been authorized under the Elementary and Secondary Education Act. Similar legislation would be useful to assist local boards of education and superintendents of institutions in strengthening their planning and programming organizations. Funds authorized under Section 4c of the Vocational Education Act of 1963 also may be used for this purpose.

The superintendents of public education and vocational education institutions require planning staffs with analytical capabilities to collect and display the information needed to make decisions that will help make the educational system be more responsive to current and prospective needs of the economy and the students who must take their place in it. While concentrating on the economic efficiency objectives, vocational educators also must ensure that the important additional objectives of education, such as contributing to the continuity of our culture, developing individual capability and personality to the fullest, and providing equal educational opportunity to all, are pursued in a meaningful manner. The planning staffs should be established formally to provide assistance to top managers of occupational education at the state and local level, using the approaches discussed in this report.

Appendix C

CHECKLIST FOR SCHOOL AND PROGRAM EVALUATIONS

Appendix C

CHECKLIST FOR SCHOOL EVALUATIONS

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
I. The Community								
A. What are the general characteristics of the geography, the economy, and the population of the area being served, and are they favorable for technical education?								
1. Geographic location								
a. Does the school seem to serve as a logical center for technical education?	General location in terms of the population it serves							
b. Are there adequate transportation facilites to permit persons both in and out of the community a relatively easy access to the school?	Accessibility of the school to people in the area							
c. What other schools share the area?								
2. Economic characteristics of the community								
a. Do the economic characteristics of the community tend to support the need for a comprehensive vocational, adult and technical education center?	Occupational status of adults Business, industrial, and distributive characteristics							
b. Does the community attitude seem to be receptive to an expanded educational program?	Action promoting community growth Economic characteristics supporting needs for programs							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
3. Population characteristics								
a. What is the projected enrollment potential for the programs planned? How many high school graduates are available each year in the area?	Educational status of adults source of data Population in need of technical education							
b. What level of support is indicated by the data?	Would the population support technical education programs?							
c. Is there a relationship with other agencies and groups that makes the school an integral part of the community?	Agencies affecting education Socio-economic information							
B. Will the population and economic base of the community sustain a long term technical education program as an additional burden?								
1. Are there enough people in the area served by the school to make class size economically and educationally sound?	Basic population and financial data regarding the school's community							
2. Are the financial resources adequate to support the existing programs as well as new programs?								
3. Does the tuition enrollment indicate a recognition of the school by the people in the vicinity of the school's community?	Number and percent of tuition students							
C. What evidence is there that the community is receptive to, and willing to, support new programs?								
1. Has there been a balanced program in terms of a variety of people served by the school?	Basic data regarding pupils--enrollment, age distribution							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
2. Does the history show a continued support of education in the community, particularly in vocational and adult education?	Educationl building history in last 10-15 years Evidence of willingness to support new programs							
3. Is there an indication in the community that there is a thorough understanding of the significance of a school of vocational and adult education?	Evidence that people understand technical education and are willing to support such programs							
II. The School								
A. How well is the school meeting its educational obligation to the community it serves in the areas of:								
Compulsory education?								
Adult education?								
Occupational preparation?								
Occupational extension?								
Post high school program developments?								
1. School administration								
a. Is the administrative organization of the school appropriate?	Qualifications of administrative personnel							
b. Is there an effective system of communication within the school?								
c. Does there appear to be a satisfactory system of accounting, budgets, and reports?	Records and controls (financial) Business managerial							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
d. Does the administrative staff perform its functions efficiently and well?								
c. Is the physical plant adequate for the objectives? Does it provide for the desired instructional program? Does it provide for the comfort and convenience of both student and staff?	Building maintenance Environment control Offices							
2. Personnel								
a. Is there adequate staff with appropriate training for currently operated programs?	Number of teachers Certification record of teachers Selection procedures							
b. Is the salary schedule adequate to assure continued maintenance of a quality staff?	Does the salary schedule encourage professional development?							
c. Are the work assignments appropriate and equitable?	Teacher loads and schedules							
d. Have the members of the professional staff made continuous efforts to improve themselves?	Provision for maintenance of professional qualifications							
e. Are the teachers and auxiliary personnel performing their functions efficiently and effectively?								
3. Equipment and supplies								
a. What is the general nature of the equipment in each shop and laboratory of the school?	Policies regarding maintenance of equipment Procedures for selection of texts, reference books, visual aids, and instructional materials							

		Superior		Accepted		Unaccepted		Findings and
Item	Criteria or Essential Points	6	5	4	3	2	1	Stipulations
	Money spent for reference books per student per year							
b. Is the procedure for replacement and purchase adequate for the growth of the program?								
4. Curriculum								
a. Is there an effective organization to provide for improvement of curriculum?	Qualified curriculum supervisor Procedure for development							
b. Is the present curriculum flexible enough to permit rapid changes to meet changing needs?	Class schedules, course descriptions, etc. Provisions for continual examination							
c. Is the academic division of sufficient scope and rigor to support a technical program?								
d. Does it provide program opportunities for all student levels within the responsibility of the school?	Are services balanced--adult, vocational, technical--in proportion to the cross-section of population?							
e. Does the school have an appropriate information and materials center including library, audio visual, curriculum development and laboratory for programmed learning?	Are facilities for modern instructional media in evidence?							
5. Student services								
a. Do the recruitment, admission, orientation, and public information procedures seem appropriate and effective?								

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
b. Is there ample opportunity for students to get counseling from qualified persons?								
c. Are there adequate provisions for helping students get employment, housing, financial assistance, and health services?								
d. Are there adequate and appropriate extra-curricular activities?								
e. Are the student accounting procedures appropriate and effective? Is there adequate information about students for effective counseling?	Student records Progress reporting							
6. School buildings								
a. Are the facilities adequate for the present program?	Location Parking facilities Library Shop facilities Classrooms Office Special rooms Lighting Accoustics Heat General appearance Maintenance							
b. Will the facilities be adequate for additional programs of technical education?								
c. Are the facilities devoted exclusively to vocational and adult education?								
d. Does the history of development indicate a future expansion?								
e. Do the plans for expansion appear adequate?								
B. What is the long range projected program of the school?								
1. Is the projected program a realistic one?	Enrollment trends Curriculum changes							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
2. Does the plan make ample provision for growth and expansion of programs and services?	Compulsory education Adult education Occupational preparation Occupational extension Post-high school							
3. Are efforts being made to extend the services to a wider range of interests and needs?								
4. Does the number of proposed technical education programs seem appropriate in light of the population and economy?	Number of technical education programs to be sustained When approval will be sought for these programs							
5. Are the relationships with other vocational and adult schools in the area satisfactory?	Plans developed in consultation with other vocational and adult schools in the area How consultation was carried on							
C. Will there be any interference with a lessening of the effort in current programs should technical education be undertaken?	Effort of school to assure program growth and meet educational needs							
1. Does the school have the financial resources to maintain the current program while establishing technical education?								
2. Does the Board and the administrative and teaching staff demonstrate an ability to maintain current programs while starting technical programs?								
3. Are there adequate facilities for growth in all programs?								

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
4. Is the professional attitude consistent with the goals recognized by the school?								
III. Summary								
Evaluation committee comments, observations, and recommendations	Purposes and responsibilities of the school General and particular needs and objectives to be met or achieved by the school Philosophy of the school							

CHECKLIST FOR PROGRAM EVALUATIONS

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
I. Supervision and Administration of the Program								
A. Is authority delegated to the department so that their responsibilities may be discharged effectively?	Lines of authority must be clearly established							
B. Is communication sustained on a professional level from director to those involved in the program?	What formal communication procedures exist? Committees, organizations, conference procedures, written communications,etc.							
C. Is supervision and administration of the program being maintained?	What is the relationship of the program to total school operation? Are leadership roles properly filled? What contribution is being made by supervision and administration to the success of the program?							
D. Does separation exist between compulsory, vocational and technial courses; between beginning and advanced technical courses; and between subject titles of the curriculum?	Are enrollment, staff, and space sufficient to schedule all necessary levels and objectives in the program?							
E. On what basis has the need for this program been determined?	What studies have been made? What follow-up information is available?							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
F. Are department heads properly qualified?	What are the strenghs? In what responsibilities does he need development?							
1. Industrial or business experience								
2. Educational background								
3. Professional growth activities								
G. Is the supervisory staff adequate? Is it properly specialized in terms of assignment? Are activities as described appropriate?								
II. Department Personnel								
A. Are teachers employed and assigned to instruction that falls within their professional education major?	Teachers should be employed in their specialty							
B. Are teacher loads adjusted equitably and at levels which allow for preparation and curriculum development?	18 class hours per week for lecture courses, 23 per week in laboratories, 30 hours per week in a full-time shop or applied situation, instructional assistants, etc.							
C. Do teachers participate in professional growth activities?	The professional growth record for each teacher should be available A school policy should exist which encourages professional growth with cyclic requirements and salary benefits							
1. In-service teacher training								
2. National, state, and privately sponsored institutes in specific areas								
3. Extension or resident college classes								
4. Professional membership and participation								

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
D. Are teachers in this program properly qualified?	Complete information should be provided by the school							
1. Education	Statement from supervisor of certification							
2. Employment experience								
3. Teaching experience								
4. Certification status								
III. Facilities - Are They Adequate?								
A. Available classrooms	At least one lecture classroom devoted to the program major Classrooms for related and academic subjects scheduled appropriately for this program							
B. Laboratories and equipment for this program	Basic laboratories available to the program--physics, chemistry, metallurgy, strength of materials, hydraulics, pneumatics, drawing							
1. Appropriate testing laboratories								
2. Do the laboratories provide opportunity for student participation?	Specialized laboratories unique to the program--electronics, architectural civil, mechanical, industrial fabrication, medical, dental, business, etc.							
3. Is equipment up to date from the standpoint of current business and industrial practice?								
4. Is safety prominent in the design and operation of classrooms, shops, and laboratories?								
5. Does the school have a planned equipment replacement program? What percent per year?								

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
6. Is audiovisual equipment adequate?								
a. Overhead projectors-transparencies								
b. Teaching machines								
c. Closed circuit TV								
d. Models, mock-ups, cutaways, etc.								
e. Filmstrip projector								
f. Movie film projector								
IV. Library	(20,000 vol./1,000 students = 6)							
A. Is the program served by a central library?	Departmental reference shelves should contain texts and references in adequate number and variety for immediate needs of a quality program. A good number of texts and references should also be available in the central library in addition to the greater variety of general and realted works							
B. What use is made of public libraries?								
C. Are specialized departmental references adequate?								
D. What provision is made for library development concerning this program?	A functioning program of library improvement should exist.							
E. Are professional and technical periodicals appropriate and of good variety?	Properly qualified personnel direct the library function including the classification and accounting of departmental books							

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings an Stipulation
		6	5	4	3	2	1	
V. Curriculum								
A. Does the curriculum as presented by the school meet the requirements of the state minimum program standards?	A qualified person should have responsibility for coordination of curriculum development. A staff person within the program major should also be assigned chief curriculum responsibility. (Refer to core curriculum-rate each; Humanities - 15 hr = 6, Math - 9 hr = 6, Science - 6 hr = 6)							
B. Do courses provide for up to date content above and beyond state standards?								
C. What is the status of teaching aids?								
1. Lesson plans								
2. Assignment sheets								
3. Information sheets								
4. Activity sheets								
5. Evaluation (testing)								
6. Texts, references, workbooks, and resource materials and people								
7. Modern instructional media								
D. Is there an organized program of curriculum research and development?								

Item	Criteria or Essential Points	Superior		Accepted		Unaccepted		Findings and Stipulations
		6	5	4	3	2	1	
VI. Student Services for the Program								
A. What provision is made for placement and follow-up data and is available to this program?								
B. To what extent are guidance services used by students in this program?								
C. How are students selected?	(Do not rate)							
D. Do students enrolled in this program show potential as semi-professional personnel in regard to ability level, academic achievement, and personality?								
E. Other student services 1. Health 2. Food 3. Transportation 4. Extracurricular 5. Housing 6. Placement								
F. What is the drop-out record of this program?	(Devalue over 1/3) Do second year enrollments indicate sound operation and good holding power? Suggested minimum for Eval.-6							
G. Are drop-outs provided alternate opportunities at the appropriate level?								
VII. Advisory Committees								
A. Are advisory committees for this program properly constituted and active?								

		Superior		Accepted		Unaccepted		Findings and
Item	Criteria or Essential Points	6	5	4	3	2	1	Stipulations
B. Meetings per year								
C. Composition of advisory committees								
VIII. What are the plans for future development?								
A. Program								
B. Campus								
C. Personnel								

Note: Suggestions for Committee Organization:

The committee is oriented by the coordinator's evaluation and by the local staff. A chairman is elected and the committee is organized.

The evaluating team may work as a committee of the whole or as subcommittees. These could be as follows:

Committee A	Committee B	Committee C
I. General	III. Facilities	V. Curriculum
II. Department Personnel	IV. Library	
VI. Student Services		

Topics VII and VIII may be handled by the committee of the whole or assigned to subcommittees.

REFERENCES

REFERENCES

1. Digest of Educational Statistics, U.S. Dept. of Health, Education, and Welfare, Office of Education, Washington, D. C., 1966, p. 17
2. Lecht, Leonard A., Goals, Priorities & Dollars, The Next Decade, National Planning Association, The Free Press, New York, 1966, p. 157
3. Vocational Education Amendments of 1966, Hearings before the General Subcommitte on Education of the Committee on Education and Labor, House of Representatives, 89th Congress, 2nd session, 1966, Part One, pp. 33-5
4. Rockefeller Brothers Fund, The Pursuit of Excellence, Doubleday, New York, 1958
5. Koontz, Harold D., and C. J. O'Donnell, Principles of Management, McGraw Hill Book Co., New York, 1955, p. 448
6. Boynton, Paul M., Connecticut Business Education Handbook, State Department of Education, Hartford, Connecticut, Bulletin No. 43, September 1966
7. Bloom, Benjamin S., Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain, David McKay Company, Inc., New York, 1956
8. The Central Purpose of American Education, National Education Association of the United States, Educational Policies Commission, 1961
9. Conant, James B., Shaping Educational Policy, McGraw-Hill, New York, 1964
10. Contemporary Issues in American Education, Department of Health, Education, and Welfare, Office of Education, 1965
11. Cressman, George R., and Harold W. Benda, Public Education in America, Appleton-Century-Crofts, New York, 3rd Edition, 1966
12. Dauwalder, Donald D., Vocational Education in the Pittsburgh Public Schools, The Pittsburgh Board of Public Education, April 1963

13. Education for a Changing World of Work, Report of the Panel of Consultants of Vocational Education, Department of Health, Education, and Welfare, Office of Education, 1963

14. Gardner, John W., National Goals in Education, in Goals for Americans, The Report of the President's Commission on National Goals, Prentice-Hall, Englewood, New Jersey, 1960

15. Imperatives in Education, American Association of School Administrators, Washington, D. C., 1966

16. Bloom, Benjamin S., Krathwohl, and Masia, Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook II: Affective Domain, David McKay Company, Inc., New York, 1956

17. Schmitt, Marshall L., and Albert L. Pelley, Industrial Arts Education, Survey of Programs, Teachers, Students and Curriculum, Circular 791, Department of Health, Education, and Welfare, Office of Education, 1966

18. Stanley, William O., et al., Social Foundations of Education, Holt, Rinehart and Winston, Inc., 1956

19. Thomas, Lawrence G., The Occupational Structure and Education, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1956

20. Vocational Education in Michigan, The Final Report of the Michigan Vocational Education Evaluation Project, Michigan State University, Office of Education, September 1963

21. Vocational Education in Utah, Division of Surveys and Field Services, George Peabody College for Teachers, Nashville, Tennessee, 1966

22. Whitehead, Alfred, The Aims of Education, Macmillan Co., 1929

23. Venn, Grant, Man, Education and Work, American Council on Education, 1964

24. One-Third of a Nation, A Report on Young Men Found Unqualified for Military Service, President's Task Force on Manpower Conservation, Washington, D. C., January 1, 1964

25. The Measurement and Interpretation of Job Vacancies, National Bureau of Economic Research, Columbia University Press, New York 1966

26. Employment Service Review, January-February 1967, pp. 61-74

27. Area Skill Survey, Department of Labor, Bureau of Employment Security, Washington, D. C., November 1965, pp. 1-2

28. Connecticut's Need for Technicians, 1963-1973, Connecticut State Board of Education, Division of Vocational Education, Hartford, Connecticut, November 1964

29. Formal Occupational Training of Adult Workers, Department of Labor, Monograph No. 2, December 1964, p. 4

30. Eninger, Max U., The Process and Product of High School Level Trade and Industrial Vocational Education in the United States, American Institute for Research, Pittsburgh, September 1965, pp. 9-52

31. Corazzini, Arthur J., Vocational Education: A Study of Benefits and Costs, draft of unpublished Ph.D. dissertation, Princeton University, July 28, 1966

32. Kaufman, Jacob I., et al., The Preparation of Youth for Effective Occupational Utilization, Institute for Research on Human Resources, Pennsylvania State University, February 1967

33. Burkhead, Jesse, "The Theory and Application of Program Budgeting to Education, " paper presented to the National Education Association, Chicago, Illinois, April 6, 1965

34. __________, Government Budgeting, John Wiley & Sons, Inc., New York, 1956, p. 110

35. Benson, Charles S., The Economics of Public Education, Houghton Mifflin Co., Boston, 1961, p. 491

36. "The Financial Characteristics and the Problems of Large City Districts," Education Administration Quarterly, III, Winter 1967, p. 18

37. James, H. T., James A. Kelly, and Walter I. Garms, Determinants of Educational Expenditures in Large Cities of the United States, Stanford University, School of Education, 1966

38. "A Progress Report on Area Vocational-Technical School Developments to March 1966," Commonwealth of Pennsylvania, Department of Public Instruction, Harrisburg, p. i

39. Manual: Application for Vocational Education Funds, Bureau of Technical and Continuing Education, Harrisburg, August 1965, p. i

40. Research Council of the Great Cities Program for School Improvement, Vocational Newsletter, No. 3, September 1966

41. Dauwalder, Donald D., and Associates, The Administration and Financing of Vocational-Technical Education in Pennsylvania, a report to the State Board for Vocational Education, December 1964, p. 8

42. Odell, William R., and Staff, Educational Survey, Report for the Philadelphia Board of Public Education, School District of Philadelphia, 1965, p. 242

43. Anshen, Melvin, "The Federal Budget as an Instrument for Management and Analysis," in Program Budgeting, David Novick (ed.), Harvard University Press, Cambridge, Massachusetts, 1965, p. 18

44. Hirsch, W. Z., Integrating View of Federal Program Budgeting, Memorandum RM-4799-RC, RAND Corporation, Santa Monica, California, December 1965, p. 7

45. Facts and Figures, 1966-1967, Board of Education, Brooklyn, New York

46. Kliever, Douglas E., Vocational Education Act of 1963: A Case Study in Legislation, American Vocational Association, Washington, D. C., 1965

47. The Vocational Education Act of 1963, Department of Health, Education, and Welfare, Office of Education, OE-80034, p. 7

48. Davie, Bruce F., and Joseph T. White, "Equalization Alternatives in Grant-in-Aid Programs: Allotment Formulas and Measures of Fiscal Capacity," National Tax Journal, June 1967

49. Measures of State and Local Fiscal Capacity and Tax Effort, Advisory Commission on Intergovernmental Relations, October 1962

50. "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources," The President's Water Resources Council, Senate Document No. 97, 87th Congress, 2nd Session, Washington, D. C., May 29, 1962

51. Carroll, Adger B., and Loren A. Ihnen, Costs and Returns of Technical Education: A Pilot Study, Office of Manpower Policy, Evaluation and Research, Department of Labor, July 1966

52. Stromsdorfer, E. W., "Determinants of Economic Success in Retraining the Unemployed: The West Virginia Experience", forthcoming in the Journal of Human Resources

53. "Capital Formation by Education," Journal of Political Economy, Vol. LXVIII, 1960

54. Hansen, W. Lee, "Total and Private Rates of Return to Investment in Schooling," Journal of Political Economy, April 1963, p. 134

55. Prest, A. R., and Ralph Turvey, "Cost Benefit Analysis: A Survey," The Economic Journal, December 1965

56. McKean, Roland N., Efficiency in Government Through Systems Analysis, John Wiley and Sons, New York, 1958

57. Eckstein, Otto, "A Survey of the Theory of Public Expenditure Criteria," in National Bureau of Economic Research, Public Finances: Needs, Sources, and Utilization, A Conference of the Universities - National Bureau of Economic Research, Princeton University Press, Princeton, New Jersey, 1961

58. Hirshleifer, Jack, et al., Water Supply: Economics, Technology, and Policy, The University of Chicago Press, Chicago, 1960, Chapters VI and VII

59. Solomon, Ezra, editor, The Management of Corporate Capital, The Free Press, New York, 1959

60. Blaug, Mark, A Selected Annotated Bibliography in the Economics of Education, Education Libraries Bulletin, Supp. Eight, Institute of Education, University of London, England, 1964

61. Hearings, The Nation's Manpower Revolution, U.S. Senate Committee on Labor and Public Welfare, Subcommittee on Employment and Manpower, Part 6, 88th Congress, 1st Session, October 1963, pp. 2099-102

62. Objectives for Vocational and Technical Education in Agriculture, U.S. Department of Health, Education, and Welfare, Office of Education, OE-81011, Bulletin 1966, No. 4, p. 2

63. Weisbrod, Burton A., "Conceptual Issues in Evaluating Training Programs," Department of Economics, University of Wisconsin, Madison, Wisconsin, February 4, 1966, mimeo.

64. Kaufman, Jacob J., et al., An Analysis of the Comparative Costs and Benefits of Vocational Versus Academic High School Education, The Institute for Research on Human Resources, The Pennsylvania State University, University Park, Pennsylvania, a study in progress

65. Weisbrod, Burton W., "Education and Investment in Human Capital," The Journal of Political Economy, Supplement, October 1962, p. 109

66. Borus, Michael E., The Economic Effectiveness of Retraining the Unemployed, Yale University Press, New Haven, 1964

67. Cain, Glen G., and Ernst W. Stromsdorfer, "An Economic Evaluation of the Government Retraining of the Unemployed in West Virginia," in Retraining the Unemployed: Case Studies of the Current Experience, Gerald G. Somers,(ed.), University of Wisconsin Press, Madison, 1967

68. Hardin, Einar, Sigmund Nosow, and Michael Borus, Measuring Benefits and Costs of Retraining Programs for Unemployed Workers, School of Labor and Industrial Relations, Michigan State University, East Lansing, Michigan, 1967

69. Page, David A., "Retraining Under the Manpower Development Act: A Cost-Benefit Analysis," Brookings Institution Reprint 86, Washington, D. C., 1964

70. Blank, David S., and George J. Stigler, The Demand and Supply of Scientific Personnel, National Bureau of Economic Research, New York, 1957, p. 24

71. Becker, Gary, Human Capital, National Bureau of Economic Research, New York, 1964, pp. 18-29

72. Bowman, Mary J., "The Costing of Human Resource Development," in The Economics of Education, E.A.G. Robinson and J. E. Vaizey, (eds.), proceedings of a conference held by the International Economics Association, St. Martin's Press, New York, 1966, pp. 442-3

73. Machlup, Fritz, The Production and Distribution of Knowledge in the United States, Princeton University Press, Princeton, New Jersey, 1962, pp. 100-1

74. Morgan, James N., and Martin David, "Education and Income," Quarterly Journal of Economics, August 1963, pp. 432-7

75. Banks, Robert, and Arnold Kotz, "The Program Budget and the Interest Rate for Public Investment," Public Administration Review, December 1966

76. Krutilla, John U., and Otto Eckstein, Multiple Purpose River Development, Johns Hopkins Press, Baltimore, 1958, Chapter 4, pp. 78-130

77. Governor's Symposium on Education and Training for Employment, Proceedings, Princeton, New Jersey, October 6, 1966, p. 7

78. Gowan, John, and George Demos, The Disadvantaged and Potential Dropout, Charles Thomas 1966

79. "Working Paper on Goals in Education," Committee on Assessing the Progress of Education, established by the Carnegie Corporation, December 1964

80. Denison, E. F., "Measuring the Contribution of Education to Economic Growth," The Residual Factor and Economic Growth, OECD, Paris 1964, p. 35

81. Clark, Harold F., Cost and Quality in Public Education, Syracuse University Press, Syracuse, New York, 1963

82. Hanoch, Giora, Personal Earnings and Investment in Schooling, The University of Chicago, Chicago, Illinois, unpublished Ph.D. Thesis, August 1965

83. Hauthakker, H. S., "Education and Income," Review of Economics and Statistics, February 1959

84. Hunt, S. J., "Income Determinants for College Graduates and the Return to Educational Investment," Yale Economic Essays, Fall 1963

85. Miller, H. P., "Lifetime Income and Economic Growth," American Economic Review, Vol. LX, No. 4, September 1965, pp. 834-44

86. Cremin, L. A., The Genius of American Education, Vintage, New York, 1966, p. 40

87. Page, David A., "Retraining Under the Manpower Development Act: A Cost-Benefit Analysis," Public Policy, Harvard University Press, Cambridge, 1964

88. Kershaw, Joseph A., and Roland N. McKean, "Systems Analysis and Education," working paper, RM-2473-FF, The RAND Corporation, Santa Monica, California, October 30, 1959

89. Renshaw, Edward F., "Estimating the Returns to Education," The Review of Economics and Statistics, Vol. XLII, No. 3, Part I, August 1960

90. Swift, W. J., and B. A. Weisbrod, "On the Monetary Value of Education's Intergeneration Effects," Journal of Political Economy, Vol. LXXIII, No. 6, December 1965

91. Fishman, Leslie, et al., Methodology for Projection of Trends in the Denver Standard Metropolitan Area, Bureau of Economic Research, Institute of Behavioral Science, University of Colorado, Boulder, Colorado, March 1966, funded under MDTA 42-64

92. Harms, Louis T., et al., Projective Models of Employment by Industry and by Occupation for Small Areas: A Case Study, Bureau of Economic and Business Research, Temple University, Philadelphia, Pennsylvania, March 1966, funded under MDTA 41-64

93. Area Redevelopment Act, Public Law 87-27, May 1, 1961, sec. 16(6)

94. Manpower Development and Training Act of 1962, Public Law 87-415, March 15, 1962, title II, pt. A, sec. 202(d)

95. Greenspan, Harry, "Estimates of Employment Requirements by Occupation for Future Periods--Data Sources and Model Development," Institute of Industrial Relations, University of California, 1966

96. Statement of Stanley H. Ruttenberg, Assistant Secretary of Labor and Manpower Administrator before the General Subcommittee on Education of the House Committee on Education and Labor on Vocational Education Act of 1963, August 16, 1966

97. An Appraisal of Area Skill Surveys in Battle Creek, Michigan, and Trenton, New Jersey, John Fletcher Wellemyer Association, Washington, D.C., November 1965

98. Dictionary of Occupation Titles, U.S. Department of Labor, Bureau of Employment Security, 1965 Vols. I and II, third edition

99. Hearings before the Subcommittee on Economic Statistics of the Joint Economic Committee, Statement of V. D. Chavrid, Director, Office of Manpower Analysis and Utilization, USES, 89th Congress, May 1966

100. Findings and Implications of the Job Vacancy Experimental Program, conducted during FY 1965 and FY 1966, USES, a preliminary paper dated September 8, 1966

101. "The Measurement and Interpretation of Job Vacancies," a conference report of the National Bureau of Economic Research, Columbia University Press, New York, 1966

102. Manpower Administration Order 33-65, "Wage Rates Appropriate to MDTA Projects in Occupations Not Covered by the Minimum Wage Act," December 29, 1965, and U.S. Employment Service Program Letter 1994, March 25, 1966

103. "Instructions for Obtaining Area Job Vacancy Information," U.S. Employment Services, March 15, 1966

104. "Estimated Need for Skilled Workers, 1965-75," Monthly Labor Review, U.S. Department of Labor, April 1966

105. Colm, G., and L. Lecht, "Requirements for Scientific and Engineering Manpower in the 1970's," in Toward Better Utilization of Scientific and Engineering Talent, Committee on Utilization of Scientific and Engineering Manpower, National Academy of Sciences, 1964

106. "Toward Full Employment," Report of the Subcommittee on Employment and Manpower, U.S. Senate, 1964, p. 79

107. Burkhead, Jesse, Thomas G. Fox, and John W. Holland, Input and Output in Large City High Schools, Syracuse University Press, 1967

108. "Innovation in Education," Educational Technology, Aerospace Education Foundation, Washington, D.C., Spring 1967

109. "The Pre-Tech Program," film prepared by Station KRON-TV, San Francisco, California, describing the Richmond Plan of technical training for high school students

110. Marshall, F. Roy, and Vernon M. Briggs, Jr., Negro Participation in Apprenticeship Programs, University of Texas, December 1966, p.48

111. Weisbrod, Burton A., External Benefits of Public Education, Industrial Relations Section, Princeton University, 1964